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ABSTRACT

This volume of the Florida Journal of Communication Disorders contains the following featured articles: (1) "Using Descriptive Language Assessment Procedure with African-American English Preschool Child Speakers: Advantages and Limitations" (Kenyatta O. Rivers and Linda J. Lombardino), which discusses best practices for using descriptive language assessment procedures; (2) "Format Frequency Differences in Vowels Produced by African American and Caucasian Male Speakers" (Julius Fridriksson and Jack Ryalls), which discusses research findings that indicate differences between the two groups; (3) "The Consistency of Kay Elemetrics Multidimensional Voice Program (MDVP) for the Acoustic Analysis of the Dysphonic Voice" (Yaser Natour and others), which discusses the high degree consistency of the MDVP system; (4) "Successful Educational Re-Entry after Severe Traumatic Brain Injury: The Contribution of Cognitive Compensation Strategies" (Larry E. Schultz and Judith A. Schults), which describes research findings that indicate training in compensatory strategies for memory, executive, and other cognitive deficits for one to four months prior to school re-entry enabled high school and college students with severe traumatic brain injuries to be placed directly in mainstream classrooms and to achieve grades comparable to or better than those earned before injury; (5) "Phonological Development in African American Children Prenatally Exposed to Cocaine" (Linda M. Bland-Stewart and others); and (6) "The Early Reading Screening Instrument: A Spanish Translation and Preliminary Study of Three Bilingual Children" (Cynthia Core and Linda J. Lombardino), which highlights findings indicating that overall reading readiness skills of the bilingual children appeared to be about the same of those of monolingual children. (Individual articles contain references.) (CR)

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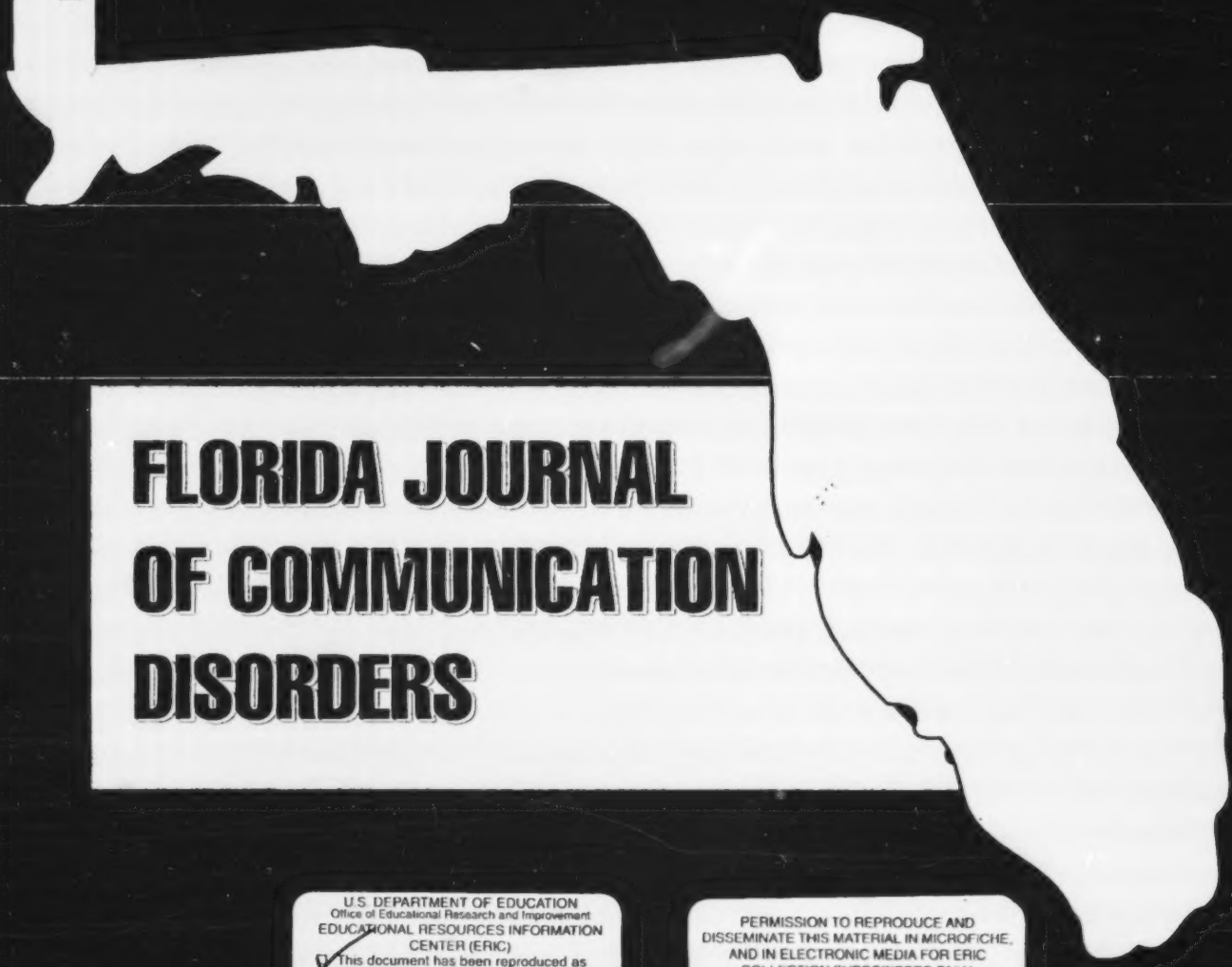

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CONTENTS

From the Editor 4

Guidelines for Submission 5

Articles

Using Descriptive Language Assessment Procedures with African-American English Preschool Child Speakers: Advantages and Limitations ..... 7 - 18
Kenyatta O. Rivers, Ph.D.
Linda J. Lombardino, Ph.D.

Format Frequency Differences in Vowels Produced by African American and Caucasian Male Speakers ..... 19 - 22
Julius Fridriksson, Ph.D.
Jack Ryalls, Ph.D.

The Consistency of Kay Elemetrics Multidimensional Voice Program (MDVP) for the Acoustic Analysis of the Dysphonic Voice ..... 23 - 27
Yaser Natour, Ph.D.
Ann Marie Climino-Knight, M.A.
Judith Wingate, M.S.
Christine M. Sapienza, Ph.D.

Successful Educational Re-Entry After Severe Traumatic Brain Injury: The Contribution of Cognitive Compensation Strategies ..... 28 - 36
Larry E. Schutz, Ph.D., ABPP
Judith A. Schutz, M.A., CCC/SLP

Phonological Development in African American Children Prenatally Exposed to Cocaine ..... 37 - 50
Linda M. Bland-Stewart, Ph.D.
Tempii Champion, Ph.D.
Yvette Hyter, Ph.D.

The Early Reading Screening Instrument: A Spanish Translation and Preliminary Study of Three Bilingual Children ..... 51 - 62
Cynthia Core, M.A.
Linda J. Lombardino, Ph.D.

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Letter from the Editor

Welcome to Volume 20 of the *Florida Journal of Communication Disorders* (FJCD). The dissemination of this edition represents my first year as Vice President of Publications and editor of this journal. This edition of the journal brings you a changed format and the opportunity to become familiar with the scholarly work being conducted in the field of speech-language pathology and audiology. The members of the editorial review board and invited reviewers worked hard to ensure that all manuscript submissions withstood rigorous reviews. We hope you will take the opportunity to read the exciting work of our fellow colleagues.

This edition of the FJCD features six articles covering a wide range of interests. Drs. Kenyatta O. Rivers and Linda Lombardino discuss the advantages and limitation of using descriptive language assessment procedures with African-American English preschool child speakers. Drs. Julius Fridriksson and Jack Ryalls explore formant frequency differences amongst African-American and Caucasian-American male speakers. Yaser Natour, Ann Marie Cimino-Knight, Judith Wingate and Dr. Christine Sapienza provide us with research examining the use of the Kay Elemetric Multidimensional Voice Program (MDVP) for the acoustic analysis of the dysphonic voice. Dr. Larry E. Schutz and Judith Schutz offer information on the effectiveness of using cognitive compensatory strategies with children in the public school setting with Traumatic Brain Injury. Drs. Linda Bland-Stewart, Tempii Champion and Yvette Hyter present information on the phonological development in African-American children prenatally exposed to cocaine. Finally, Cynthia Core and Dr. Linda Lombardino describe an early reading screening instrument and present us with preliminary data on its' use with Hispanic children.

I would like to thank the many individuals who served on the editorial review board and invited reviewers for their time, energy and expertise in reviewing the submitted articles in a timely manner. I would also like to extend a thank you to Tina Kautter, the FLASHA Association Office, and Elaine York for their assistance in formatting and laying out the new look for the journal. I would like to thank my Graduate Assistants, Marni Simon, Aileen Grullon and Danielle St. Jean, who worked with me as I learned the editorial process. A sincere appreciation to Donna Lundy, Immediate Past Vice President for Publications, who shared her expertise with me in putting this edition together.

Last, I would like to sincerely thank and congratulate all of the authors who have generously submitted their work to the FJCD. The journalistic process is a scholastic activity involving great amounts of time, effort and motivation. I continue to welcome manuscript submissions as I begin my work on the 21st edition of the FJCD.

Enjoy the 20th edition of the *Florida Journal of Communication Disorders*.

Linda Iris Rosa-Lugo, Ed.D, Editor
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Guidelines/Information for Authors

General Editorial Policy

No manuscript that has been published or is under consideration elsewhere should be submitted. The *Journal* reserves the right to keep any manuscripts submitted. It cannot assume responsibility for loss of manuscripts. Contributed manuscripts pertaining to clinical research, clinical practice, methodology or strategies must reflect the highest levels of scholarship in the use of evidence and logic.

Types of Manuscripts

Articles. Articles may be philosophical, conceptual, or synthesizing papers on topics of clinical importance. Contributed manuscripts may deal with all aspects of clinical services, to include descriptions of assessment and treatment procedures, professional issues and criteria for serving specific populations.

Reports. Reports may be data-based descriptive or experimental studies that pertain to all aspects of clinical service. They are judged in terms of scientific merit and clinical relevance to practitioners. Typically, reports reflect within- or between-subject experimental designs that evaluate the appropriateness or effectiveness of a particular assessment or treatment procedure. The demonstration of internal and external validity is mandatory in such reports. Reports may also be case studies presentations that describe new clinical approaches, new or unusual findings, or new insights. The reports also require demonstration of the reliability of the data reported.

Clinical Forums. Clinical Forums are a series of articles on a particular topic. Contributors interested in organizing a clinical forum should contact the Editor. Suggestions for future clinical forms are welcomed.

Editing

Clarity and precise writing style should be used. Manuscripts considered acceptable for publication may be returned to the author for revision. Following this, papers are edited to improve effectiveness of communication. When editing is extensive, papers are returned to the author for correction and approval. Authors are free to make additional minor changes at this stage. Once a manuscript has been accepted and forwarded to the Association Office, the publication staff may edit further for style, clarity and consistency.

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Manuscripts and editorial correspondence should be sent to Linda I. Rosa-Lugo, Ed.D, Editor, The Florida Journal of Communication Disorders, Department Communicative Disorders, University of Central Florida, P.O. Box 162215, Room 110, Orlando, Florida 32816-2215.

Manuscripts Style and Requirements

Contributors are expected to follow the style specified in the Publication Manual of the American Psychological Association (5th Ed.). In addition, authors are encouraged to use nonsexist language and to use person-first language in preparing manuscripts.

To ensure the clarity of scientific communication in this journal, articles will not exceed 10 printed pages. This is approximately equivalent to 40 manuscript pages, including title page, abstract, reference, tables and figures.

Four high quality, typed, completely double-spaced, unstapled copies of the manuscript should be submitted. Erasable bond and onion skin paper are not acceptable. Those authors wishing to remain anonymous to the editorial reviewers during the review process should submit three of these copies with no names or institutional references by which a reviewer could identify the author. Responsibility for removal of identifying information rests with the author.

Table and figures. Copies of tables and figures should be attached to each copy of the manuscript. Use Arabic numerals for both tables and figures, and do not use suffix letters for complex tables; instead, simplify complex tables by making two or more separate tables. Table titles and figure captions should be concise but explanatory. The reader should not have to refer to the text to decipher the information. Glossy or otherwise camera-ready prints of figures should be submitted with the manuscript.

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All manuscripts should be accompanied by a cover letter requesting that the manuscript be considered for publication and stating that the manuscript has not been previously published and is not currently submitted elsewhere. The contact author's business address and phone should be included.

Using Descriptive Language Assessment Procedures with African-American English Preschool Child Speakers: Advantages and Limitations

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ABSTRACT: *Norm-referenced language assessment procedures are commonly used by speech-language pathologists (SLPs) when they are evaluating the linguistic abilities of preschool children. However, these formal instruments have been shown to provide insufficient, invalid, and unreliable information regarding the linguistic skills of many African American English (AAE) preschool children. Therefore, it is recommended that descriptive, less formal language assessment procedures and analysis techniques be used by SLPs when they are evaluating the language abilities of AAE preschool child speakers. The participation of caregivers and other professionals should be solicited by SLPs during the evaluation process using descriptive instruments such as language questionnaires, checklists, and rating scales. Caregivers' ratings and descriptions of the linguistic and communication behaviors of the AAE child speakers with whom they regularly interact can provide valuable information. SLPs should be familiar with both the advantages and limitations of descriptive procedures to ensure that they are used judiciously.*

KEY WORDS: *descriptive language assessment procedures, language evaluations, African American English, preschool language deficits, formal language assessment procedures*

Of the more than 260 million people living in the United States, there are approximately 33 million African Americans. People of African descent, including individuals from Caribbean areas (e.g., Cuba, Dominican Republic, Virgin Islands, Jamaica, Puerto Rico, Trinidad, Tobago), form the largest ethnic minority group in the U.S. (Terrell, Battle, & Grantham, 1998; U.S. Bureau of the Census, 1996).

The linguistic system or dialect used by a number of African American children and adults living in both urban and rural geographical areas is called African American English (AAE), sometimes referred to in the literature as "Black English" or "Ebonics" (Battle, 1996; Craig & Washington, 1994; Dillard, 1972; Labov, 1972; Stockman, 1986; Wolfram & Fasold, 1974; Wyatt, 1995). Many linguistic features produced by AAE speakers differ from those produced by Standard American English (SAE) speakers; yet, the linguistic patterns exhibited by both AAE adult and child speakers have been shown to be systematic, rule-governed behaviors (Battle, 1996; Craig & Washington, 1995; Dillard, 1972; Labov, 1972; Seymour, Bland-Stewart, & Green, 1998; Wyatt, 1995). Detailed discussions of the linguistic features commonly produced by AAE child speakers can be found in Battle (1996), Craig and Washington (1995), Seymour et al. (1998), Washington and Craig (1994), and Wyatt (1995).

Similar to the linguistic diversity seen among speakers of SAE and other nonstandard American English dialects (e.g., Hispanic American English, Southern White English), a range of linguistic diversity and skills can also be seen among speakers of AAE (Craig & Washington, 1994, 1995; Dillard, 1972; Hale-Benson, 1986; Labov, 1972; Ratusnik & Koenigsknecht, 1975; Seymour et al., 1998; Wyatt, 1995, 1996). The frequency in which AAE features are produced by children, in particular, can be heavily influenced by many factors, including the child's chronological age, socioeconomic status, gender, and family size, their caregivers' usage of AAE, the linguistic task (e.g., imitation, narration, dialogue), the conversational topic(s) or setting(s), and the ethnic background and gender of evaluators/conversational partners (Battle, 1996; Craig, Washington, & Thompson-Porter, 1998; Ratusnik & Koenigsknecht, 1975; Taylor & Samara, 1985; Washington & Craig, 1994; Wyatt & Seymour, 1990).

When assessing AAE child speakers with potential language deficits, a number of clinicians and researchers have strongly recommended that speech-language pathologists (SLPs) should

use procedures that are valid, reliable, and sensitive for evaluating and describing the unique linguistic skills of AAE child speakers (Campbell, 1996; Craig & Washington, 1994; van Keulen, Weddington, & DeBose, 1998; Wyatt,1998). Unfortunately, many SLPs appear to have difficulties in selecting appropriate procedures. A number of factors seem to have contributed to this quandary, including (a) the limited developmental information and normative data on African American child speakers' acquisition and usage of AAE features, (b) the paucity of procedures in which authors have incorporated existing literature on AAE child speakers' language development, (c) the lack of SLPs who are knowledgeable of language differences and disorders in AAE child speakers, and (d) the lack of SLPs who are competent in using descriptive language assessment procedures (Campbell, 1996; Campbell & Taylor, 1992; Craig & Washington, 1994; Seymour et al., 1986; 1998; Wyatt, 1995; Wyatt & Seymour, 1999).

While SLPs have found formal, norm-referenced language assessment procedures useful in identifying and describing the linguistic abilities and deficits of Standard American English (SAE) child speakers, the validity and reliability of these procedures have been criticized when they are used to evaluate the linguistic skills of AAE child speakers (Seymour & Bland, 1991; Seymour & Miller-Jones, 1981; Stockman, 1986; Taylor & Payne, 1983; Terrell & Terrell, 1983; Vaughn-Cooke, 1986; Washington, 1996; Wyatt, 1998). It has been argued by a number of clinicians and researchers that most formal procedures are based on a language system, in particular SAE, that is different from the language system commonly used by many AAE child speakers. It has also been argued that formal procedures frequently (a) reflect the values, mores, and perceptions of non-AAE speakers, (b) evaluate language skills that are not characteristic of many AAE child speakers' linguistic or cultural environments, (c) include tasks, stimuli, and topics that are unfamiliar to AAE child speakers, (d) require response patterns that may be inconsistent with the communication styles of AAE child speakers, and (e) offer minimal guidance for developing and implementing appropriate clinical and academic services for AAE child speakers who exhibit language deficits and disorders (Campbell, 1996; Craig & Washington, 1994; Hale-Benson, 1986; Hilliard, 1987; Taylor & Payne, 1983; van Keulen et al., 1998; Vaughn-Cooke, 1986; Wyatt, 1998).

To ascertain valid and reliable information about AAE preschool child speakers' language abilities and to circumvent many of the biases oftentimes associated with formal instruments when they are used with AAE preschool child speakers, SLPs should be knowledgeable of and use a variety of descriptive language assessment procedures. Toward that end, this article begins with a general discussion of a classification system that was developed by Damico (1993) for classifying descriptive language assessment procedures that can be used to identify and evaluate children who exhibit language impairments. This discussion is followed by specific information and assessment procedures that characterize each of the three descriptive procedure categories - probe procedures, behavioral sampling procedures, and language rating scale, checklist and questionnaire procedures. Implications of using the various descriptive procedures in each category with AAE preschool child speakers are discussed, and a case study is provided in each category to assist clinicians in discovering appropriate ways for using selected descriptive language assessment procedures with AAE preschool child speakers. Lastly, general limitations of descriptive language assessment procedures are discussed as well as general benefits and best practices for using them during speech and language evaluations of AAE preschool child speakers are provided.

Descriptive Language Assessment Procedures

With a paucity of valid and reliable formal language assessment procedures available for evaluating the language abilities of AAE child speakers, SLPs are strongly encouraged to use descriptive language assessment procedures (Campbell, 1996; van Keulen et al., 1998; Washington, 1996; Wyatt, 1998). Descriptive language assessment procedures are designed to (1) provide clinicians with instruments and tools needed to gain a greater understanding of the unique linguistic and communication behaviors of AAE child speakers (Leonard & Weiss, 1983; Seymour & Miller-Jones, 1981; Terrell & Terrell, 1993; van Keulen et al., 1998; Washington, 1996; Wyatt, 1998), (2) provide clinicians with assessment and tools that can be used for conducting in-depth evaluations of children's language strengths and weaknesses (Blau, Lahey, & Oleksiuk-Velez, 1984; Owens, 1999; van Keulen et al., 1998; Washington, 1996), (3) provide clinicians with assessment tools for guiding their observations of children's behaviors and for describing the children's language and communication skills as they occur naturally in meaningful situations and contexts (Campbell, 1996; Mitchener-Colston, 1996; van Keulen et al., 1998), (4) assist clinicians in determining appropriate academic and clinical services for preschool and school age children, including speech-language services, and (5) provide clinicians with assessment tools for summarizing and monitoring children's language and communication abilities over time in different settings, during different tasks, and with different conversational partners (Blau et al., 1984; Campbell, 1996; Damico, 1993; Muma, 1986; Owens, 1999; Paul, 1995a).

A variety of descriptive language assessment procedures that can be used with children have been discussed in the literature (Damico, 1993; Miller, 1981; Owens, 1999). Damico (1993) developed a classification system that is composed of three categories to organize and describe the various procedures. His categories are: probe procedures, behavioral sampling procedures, and rating scale, checklist, and questionnaire procedures.

According to Damico (1993), probe procedures are assessment procedures that allow SLPs to elicit specific language features, patterns, and behaviors from the children engaged in different activities or tasks. Probe procedures include elicitation and imitation tasks, role-playing activities, and closed- and open-ended question tasks. Behavioral sampling procedures are procedures that vary in structure and complexity allowing clinicians to observe and gather samples of children's "everyday" language skills and academic skills. These procedures include story grammar tasks, language sampling, play-based assessments, and reading tasks. Language rating scales, checklists, and questionnaire procedures are instruments that SLPs, caregivers, and other professionals (e.g., teachers, physicians, school psychologists, learning specialists, classroom assistants) can use to identify and describe children's language skills and cognitive abilities as they participate in a variety of activities and tasks.

Probe Procedures

Probe procedures are usually used to gather information about preschool children's abilities to produce a range and diversity of language and communication forms (e.g., pronouns, irregular past tense verbs, modals, wh-questions, passive sentences, interrogatives, fricatives, affricates, lingua-alveolars, re-

quests for action or attention, greetings). They can also be used to evaluate various aspects of communication effectiveness, including problem solving, organizing, and giving directions (Damico, 1993).

Probe procedures that have been discussed in the literature for gathering information about children's semantic, morphosyntactic, and pragmatic abilities include the "Probes for Eliciting Conversational Behaviors" procedure (Brinton & Fujiki, 1992), the "Eliciting Wh-Questions: Puppet Show Procedure" (Werner, Goossens, & Green, 1981), the "Modeling Procedure for Eliciting Wh-Questions" (Marks, Frye-Osier, Reichie, & Schwimmer-Gluck, 1981), the "Word Order in Production: An Elicitation Task" (Chapman & Miller, 1981), and the "Peanut Butter Protocol" (Creaghead, 1984). With regards to evaluating children's phonological skills, Dubois and Bernthal (1978) suggested three probe procedures. They stated that clinicians can have their clients (1) discuss pictures that elicit "continuous" speech productions, (2) re-tell a story following the clinician's model, and (3) spontaneously name pictures that elicit specific phonological features or patterns.

Implications of Using Probe Procedures with AAE Preschool Child Speakers

Although the previously mentioned probe procedures and others have been shown to be effective in collecting meaningful information about SAE preschool child speakers' language strengths and weaknesses, many of them have not been subjected to the scientific rigor necessary for establishing their usefulness when they are used to differentiate language differences from language disorders in AAE preschool child speakers. Therefore, it is recommended that SLPs should exercise caution when using them during evaluations of AAE preschool child speakers. It is also recommended that clinicians should look for additional evidence or verify their findings using other evaluation instruments and descriptive procedures. For example, that information can be obtained by using procedures that focus on distinguishing non-dialect specific or non-contrastive features from dialect specific or contrastive features or by using procedures that focus on the absence of grammatical features in obligatory contexts versus variable contexts (Battle, 1996; Seymour et al., 1998; Wyatt 1996). The following case example underscores this point:

Case Study:

During her language evaluation, Keisha, a 4.0-year-old AAE child speaker, was administered several word order production probe tasks to complete an in-depth assessment of her morpho-syntactic abilities. One of the tasks used by the SLP was the "Word Order in Production: An Elicitation Task" (Chapman & Miller, 1981). This task required Keisha to label and demonstrate the actions exemplified by verbs in 24 sentences (e.g., The boy is hitting the girl; The dog is chasing the boy; The car is pushing the boy). Each sentence that Keisha verbally produced by maintaining the appropriate ordering of the subject and object relative to the verb was scored as a correct response. Also, the accurate demonstration of each sentence was scored as a correct response (e.g., Child would say, "The dog is chasing the boy," while demonstrating the action with toy replicas of a dog chasing a boy). The clinician observed that Keisha showed accurate demonstrations of each of the sentences, but she frequently omitted the auxiliary "is" during her verbal productions of most sentences (e.g., "The dog is chasing the boy" was changed to "The dog chasing the boy"). Thus, all of Keisha's sentence demonstrations were scored as correct (24 of 24) while only two of her 24 verbal productions were scored as correct. Initially, the clinician postulated that Keisha was delayed in her acquisition of the auxiliary "is." However, after reviewing Keisha's production of auxiliary "is" during other language assessment activities in which its usage was obligatory for both AAE and SAE, the clinician posited that Keisha's frequent omission of auxiliary "is" during the probe task was a common linguistic pattern used by many AAE speakers who omit various features (e.g., omission of possessive "-s;" omission of present progressive "-ing") in non-obligatory linguistic contexts. Therefore, Keisha was described as exhibiting a linguistic pattern reflective of a language difference, not a language disorder.

Additional Probe Procedures That Can Be Used with AAE Preschool Child Speakers

Craig et al. (1998) constructed two probe tasks - a "Responses to Wh-Questions Task" procedure and a "Reversible Sentence Task" procedure - for collecting information about the morphosyntactic comprehension abilities of 63 African American children in preschool (n = 12), kindergarten (n = 32), and first grade (n = 19). The "Responses to Wh-Questions Task" procedure was developed to probe the children's comprehension of requests for information presented in the form of wh-questions. The "Reversible Sentence Task" procedure was developed to probe the children's comprehension of two sentence types, active sentences and passive sentences. Craig et al. (1998) found that both procedures reliably described young African American children's comprehension of wh-questions, active sentences, and passive sentences. Therefore, they suggested that "Responses to Wh-Questions Task" and "Reversible Sentence Task" procedures should be included in the language evaluations of young African American children with potential comprehension deficits.

Behavioral Sampling Procedures

Behavioral sampling procedures can be used to obtain information about preschool children's "everyday" language skills, in general, and about their communication competence and performance (e.g., ability to participate in dual roles as speaker and listener; ability to recognize and repair communication breakdowns; ability to initiate and maintain topics), specifically (Damico, 1993). Behavioral samples can be collected while children are participating in a variety of conversational tasks (e.g., dialogue, narration), in different settings (e.g., home, school), in different situations (e.g. play, circle time), and with a variety of conversational partners (e.g., peers, SLPs, caregivers, teachers) (Owens, 1999; Paul, 1995a).

According to Damico (1993), there are three major types of behavioral sampling procedures: (1) play-based assessment activities, which are activities that allow SLPs to observe and describe preschool children's language, communication, cognitive, and physical abilities while children play with objects and interact with people in their environments (Athey, 1984; Bates, MacWhinney, Caselli, Devescove, Natale, & Vanza, 1984; Linder, 1993; McCune-Nicholich, 1981), (2) language sampling, which are activities that allow clinicians to collect samples of children's

"everyday," spontaneous language (Owens, 1999; Paul, 1995a; Stockman, 1996; Vaughn-Cooke, 1986; Wilson, Blackmon, Hall, & Richoltz, 1991), and (3) story grammar tasks, which are typically activities that allow clinicians to gather samples of children's narrative discourse skills (Damico, 1991, 1993; Hicks, 1991; Hudson & Shapiro, 1991; McCabe & Peterson, 1991; Peterson & McCabe, 1983; Preece, 1987; McCabe & Rollins, 1994).

Of the three major types of behavioral sampling procedures, language sampling is one of the most valued procedures of SLPs (Wilson et al., 1991). Wilson et al. (1991) found that SLPs viewed language sampling as an effective method for acquiring information about children's spontaneous and self-generated speech, language, and communication skills. Their findings are consistent with the notion that language sampling is a useful procedure for obtaining information about children's development (e.g., usage of different word classes, grammar usage, turn-taking, topic initiation and maintenance, phonological and morphological development), regardless of their age or their cultural or linguistic background (Craig, 1996; Leonard & Weiss, 1983; Owens, 1999; Paul, 1995a; Seymour & Miller-Jones, 1981; Stockman, 1996; Vaughn-Cooke, 1986).

After language samples have been transcribed, they can usually be coded and analyzed by SLPs to determine preschool children's competence and mastery of an array of semantic, morpho-syntactic, pragmatic, and phonological features and forms. Procedures that can be used to describe children's semantic abilities include type-token ratio (TTR; Templin, 1957), Semantic Field Analysis (Miller, 1981), and Semantic Categories Scheme (Retherford, Schwartz, and Chapman's as reported in Miller, 1981). Mean Length of Response (MLR; Templin, 1957), Length-Complexity Index (LCI; Barlow & Miner, 1969; Shriner, 1969), Mean Length of Utterance (MLU; Brown, 1973), Developmental Sentence Score system (DSS; Lee, 1974), Assigning Structural Stage Procedure (ASS; Miller, 1981), and Frequency Distribution of Utterances by Length and Structural Type (Miller, 1981) are procedures that can be used to characterize children's morpho-syntactic skills. Procedures that can be used to examine children's pragmatic abilities include Dore's Speech Act Taxonomy (Dore, 1974), Halliday's Speech Act Taxonomy (Halliday, 1975), Folger and Chapman's Pragmatic Analysis of Spontaneous Imitations (Folger & Chapman, 1978), and Fey's Conversational Classification Scheme (Fey, 1986). Phonetic inventory procedures and inventories of the frequency of occurrence of various phonological processes procedures can be used to summarize children's articulation/phonological proficiency (Shriberg & Kwiatkowski, 1980).

Although story grammar tasks, in particular narrative discourse task, have not been used by researchers and clinicians as frequently in the past as other behavioral sampling procedures (e.g., language sampling) to gather information about young children's developing language, their popularity has increased steadily over the past 20 years. Hester (1996) asserted that "Narratives are ideal for studying language use because they involve units of extended text and are used in both social and educational settings" (p. 228). Researchers have shown that young children who have difficulties producing narratives oftentimes also have underlying oral language and language-related literacy impairments (Feagans, 1982; McCabe & Rollins, 1994; Michaels, 1981; Roth & Spekman, 1986; Weaver & Dickinson, 1982).

Implications of Using Behavioral Sampling Procedures with AAE Preschool Child Speakers

Behavioral sampling procedures provide opportunities for children from culturally and linguistically diverse backgrounds, including AAE preschool child speakers, to display their "natural," self-generated language abilities and their narrative discourse skills (Champion, 1998; Gutierrez-Clellen & Quinn, 1993; Hester, 1996; Hyter & Westby, 1996; Stockman, 1996). These procedures also provide SLPs with opportunities to integrate important variables like flexibility and cultural sensitivity, which are oftentimes described as missing in formal, standardized language assessment instruments (Champion, 1998; Stockman, 1996).

Although language sampling can be an effective tool for obtaining information about AAE preschool child speakers' linguistic abilities, SLPs should realize that the amount of useful information obtained from them can decrease substantially if modifications are not made in stimuli, activities, tasks, and conversational topics. The amount of useful information can also decrease if stimuli, tasks, and activities are not culturally sensitive and relevant and if samples are not collected that are representative of the children's "everyday" language abilities (Champion, 1998; Craig, 1996; Hester, 1996; Hyter & Westby, 1996; Leonard & Weiss, 1983; Stockman, 1996; van Keulen et al., 1998; Vaughn-Cooke, 1986; Wyatt, 1998). Stockman (1996) asserted that "language is known to vary with such factors as the type of task, oral instructions, participant structure, stimuli, place of sampling, and so on" (p. 357).

When analyzing language samples of AAE child speakers, Holland and Forbes (1996), Seymour et al. (1998), and others advanced that it is important for SLPs to understand that some aspects of semantics, morphosyntax, phonology, and pragmatics [e.g., type-token ratio, turn taking, topic initiation, demonstratives, articles, present progressive -ing, negation (no, nobody, can't), modals (will, could, can), phoneme acquisition] are relatively independent of children's dialect usage (e.g., SAE, AAE) while other aspects of language (e.g., possessive markers, plural markers, subject-verb agreement, copula usage, double modal usage, regular past tense "-ed" markers, deletion of final clusters in final consonant clusters, unstressed initial syllables omitted) are not. Thus, clinicians who evaluate the linguistic skills of AAE preschool child speakers must decide if it would be more diagnostically useful for them to (1) evaluate an AAE preschool child's linguistic performance to the expected performance of other typically developing AAE preschool child speakers, (2) only evaluate those linguistic features produced by an AAE preschool child speaker that are used in both AAE and SAE, or (3) evaluate an AAE preschool child's linguistic performance to the expected performance of SAE preschool child speakers (Holland & Forbes, 1986; Seymour et al., 1998). If they choose to compare the AAE child speaker's production of linguistic features to features typically produced by other AAE preschool child speakers of a similar chronological age or gender, they should realize that the developmental course of many AAE features is not known (Craig et al., 1998; Holland & Forbes, 1986). If they choose to only evaluate those linguistic features that are expected to be produced in both AAE and SAE, the clinician may overlook linguistic problems that the child may be having with features that are characteristic of either AAE or SAE; thus, potential language delays or deficits could be ignored, disregarded, or misdiagnosed (Holland & Forbes, 1986). On the other hand, if they choose to

compare the AAE child speaker's production of linguistic features to features typically expected of SAE preschool child speakers, clinicians are at risk for misidentifying or underestimating the child's abilities. The following case example seems to underscore this latter point:

Case Study:

Dominique, a 4.6-year-old African American male preschooler, was suspected of having a language disorder by his teacher. She felt that Dominique's frequent omission of copulas, present progressive "-ing," and regular past tense "-ed" in his spontaneous language was indicative of a deficient linguistic system. Therefore, she referred him to the pre-kindergarten handicapped assessment team of his local school district for a language evaluation. During the evaluation, the SLP elicited a language sample of 70 utterances from Dominique. His morphosyntactic patterns were analyzed and scored using the Developmental Sentence Score (DSS) system (Lee, 1974). Linguistic features and patterns that were consistent with AAE and that were contrastive between AAE and SAE (e.g., omission of copulas, present progressive "-ing," and regular past tense "-ed") did not receive any points in accordance with the rules for computing DSS scores. Dominique's DSS score was 6.0, which falls at approximately the 10th percentile for a 4.6-year-old (or greater than 1.0 standard deviations below the mean). After reviewing Dominique's performance, it seemed to the clinician that some of Dominique's morphosyntactic patterns were characteristic of AAE. Therefore, she decided to recompute his morphosyntactic patterns using the Black English Sentence Scoring (BESS) system (Nelson, 1998; Nelson & Hyter, 1990). It was the clinician's view that she would gain a greater understanding of Dominique's language strengths and weaknesses if she recalculated his score by giving him credit for linguistic patterns and features that were characteristic of AAE.

Following the BESS rules, Dominique was given credit for the presence or absence of linguistic features that were known to be contrastive between AAE and SAE. His recomputed BESS score was 7.5, which fell within 1.0 standard deviations of the mean for a 4.6-year-old according to Nelson's (1990) norms. The clinician concluded that Dominique's morphosyntactic skills were within normal limits for his chronological age and that greater information was obtained about his linguistic abilities when credit was given for features and patterns that were contrastive between AAE and SAE.

Similar to language sampling, story grammar tasks (or oral narration tasks) allow clinicians to gather information about AAE child speakers' language abilities (Champion, 1998; Gutierrez-Clellen & Quinn, 1993; Hester, 1996; Hyter & Westby, 1996). For example, clinicians can gather information about the flexibility and variability of AAE preschool child speakers' morphosyntactic, semantic, and pragmatic skills and information about AAE child speakers' knowledge and understanding of the rules for generating narrative discourses. Information about AAE child speakers' abilities to codeswitch and style shift when speaking in different settings and with different conversational partners can also be collected during narrative discourse tasks (Champion, 1998; Gutierrez-Clellen & Quinn, 1993; Hester, 1996; Hyter & Westby, 1996). However, it is important for clinicians to be mindful during story grammar tasks that AAE preschool child speakers' narrative discourses can be affected by the requirements of a task (e.g., recall of a book, recall of a movie, stories elicited using pictures), by the contexts and settings in which the tasks are given, and by their culture(s), experiences, and world knowledge. (Champion, 1998; Gutierrez-Clellen & Quinn, 1993).

Clinicians should exercise caution when using narrative analysis procedures that were developed primarily for analyzing and describing the narrative discourse skills of SAE child speakers (Champion, 1998; Gutierrez-Clellen & Quinn, 1993; Hester, 1996; Hyter & Westby, 1996; McCabe & Rollins, 1994). Narrative analysis procedures developed by Labov (1972), the Labov High Point Narrative Analysis Procedure, and Gee (1986), the Gee Stanza Analysis Procedure, are helpful when used to analyze the narrative discourse skills of AAE child speakers; however, other narrative analysis procedures that are sensitive to the linguistic features of AAE should also be used, so that clinicians can gain a greater understanding of AAE preschool child speakers' narrative discourse abilities (Champion, 1998; Hyter & Westby, 1996).

Other procedures that have been shown to be effective in analyzing and describing the narrative discourse skills of AAE child speakers' include Spradley's Thematic Analysis Procedure (Spradley, 1980), Okepewho's Analysis Procedure (Okepewho, 1992), and Champion's Interactional Sociolinguistic Analysis Procedure (Champion, 1998). Discussions of the previously mentioned analysis procedures and others can be found in Champion (1998), Gutierrez-Clellen and Quinn (1993), and Hyter and Westby (1996).

Additional Behavioral Sampling Procedures and Analysis Techniques That Can Be Used with AAE Preschool Child Speakers

Craig et al. (1998) discussed a procedure that has been found to be effective for characterizing the morphosyntactic abilities of AAE child speakers during connected speech (or language sampling) called "communication units" (or "C-units) (Craig et al., 1998). C-units are defined as independent clauses and the modifiers that accompany them (Loban, 1976). Craig et al. (1998) provided data on the average C-unit lengths in morphemes and words that AAE child speakers can be expected to produce at three age levels (4-, 5-, and 6-years) and two grade levels (preschool, kindergarten). According to Craig et al. (1998), "average C-unit length appears to be unaffected by variations in dialectal marking" (p. 439); thus, the C-unit analysis procedure appears to be a viable technique for describing the global morphosyntactic abilities of AAE child speakers even though the developmental course of most AAE features and patterns, including morphosyntactic features, is not known. They suggested that clinicians should calculate AAE child speakers' average C-unit lengths in words and morphemes early in the language evaluation process so that appropriate decisions can be made regarding what, if any, additional morphosyntactic analysis procedure should be performed.

Stockman's (1996) minimal competency core (MCC) procedure is another procedure that has been shown to be useful for analyzing the linguistic skills of AAE preschool child speakers obtained through language sampling. According to Stockman (1996), MCC is "the least amount of knowledge that one must exhibit to be judged as (a) normal (language user) in a given age range" (p. 358). She advanced that the MCC procedure can be

used by SLPs as a criterion-referenced procedure for screening and describing AAE preschool child speakers' phonological, pragmatic, semantic, and morphosyntactic skills in conversational speech discourse. Specifically, she stated that the MCC procedure could be used "to identify the set of linguistic features that the least competent normal child should demonstrate. A child with language delay should be less competent than the least competent normal child at a given age" (p. 359). By using the MCC procedure, clinicians can ascertain information about AAE child speakers' linguistic skills, which should enable them to better differentiate language differences and language deficits in AAE preschool child speakers. A detailed discussion of the MCC analysis procedure can be found in Stockman (1996).

Language Rating Scale, Checklist, and Questionnaire Procedures

Language rating scale, checklist, and questionnaire procedures are evaluation instruments that SLPs, caregivers, and other professionals (e.g., teachers, classroom aides, early intervention specialists, nurses, physicians, learning specialists) can use to rate or characterize the language and communication behaviors that they observe preschool children producing while interacting with a variety of objects and people in different contexts (Damico, 1993; Paul, 1995a). These procedures also permit SLPs, caregivers, and other professionals to rate and/or describe children's abilities in collateral developmental areas including socioemotional maturation, cognitive development, and physical growth and maturation.

While it is clearly the responsibility of SLPs to determine a child's dialect status as an AAE or SAE speaker, caregivers and other professionals can provide valuable information using rating scales, checklists, and questionnaires as to whether or not a child's communication skills are similar or dissimilar to other children from the same cultural and linguistic background (Campbell, 1998). In addition, caregivers can provide clinicians with supplemental information about an AAE child speaker's medical, developmental, and health history with checklists and questionnaires and during the case history interview that can not typically be obtained with formal language assessment procedures or other descriptive procedures. Teachers and other professionals can provide detailed profiles of an AAE preschool child speakers linguistic strengths and weaknesses and communicative effectiveness in the classroom environment. The information obtained can be used by SLPs to differentiate linguistic behaviors produced by AAE child speakers that are characteristic of language differences versus language disorders (van Keulen et al., 1998; Wyatt, 1998; Wyatt & Seymour, 1999).

Although few descriptive instruments are available for specifically characterizing the overall development and behavioral patterns (e.g., language, socioemotional) of AAE preschool child speakers, a number of instruments are available for caregivers, SLPs, and other professionals to use for rating and describing the verbal and nonverbal abilities of preschool children in general. These procedures include the following: "A Worksheet for Analyzing Communicative Skills" rating scale (Paul, 1995b), the "Discourse Skills Checklist: Molar Analysis" (Bedrosian, 1985), the "Socioemotional Dimensions to Young Children with Communication Disorders" questionnaire (Paul, 1995c), "The Rosetti Infant-Toddler Language Scale - Parent Questionnaire" (Rosetti, 1990), the "Ages and Stages Questionnaires (ASQ): A Parent-Completed, Child Monitoring System - 2nd edition" (Bricker, Squires, Mounts, Potter, Nickel, Twombly, & Farrell, 1997), the "Child Development Inventory" (Ireton, 1992), the "Child Development Inventory: Teacher's Observation Guide" (Ireton, 1995), and the "Language Development Survey" (Rescorla, 1989).

Implications of Using Language Rating Scales, Checklists, and Questionnaires Procedures with AAE Preschool Child Speakers

Although language rating scales, checklists, and questionnaires can be useful tools for gathering information about the linguistic and communication styles and abilities of AAE preschool child speakers and their families and other culturally and linguistically diverse children and their families, clinicians should be aware of variables that can influence the validity and reliability of the information obtained with them from informants. These variables include, but are not limited to, the overall construction and organization of the instrument and its items, the intelligibility of the instrument's instructions/directions, the amount of time that is necessary for completing the instrument, and the informant's overall familiarity with completing rating scales, checklists, and questionnaires (Darley & Spriestersbach, 1978; van Keulen et al., 1998; Wyatt, 1998). Other variables include the informants' level of understanding of normal speech and language development, their beliefs and views regarding handicaps, disorders, and disabilities, their level of understanding of the importance of early intervention services for young children, their beliefs and opinions on sharing personal information and experiences with non-family members and service providers, their comprehension and interpretation of questions and statements appearing on the procedure, and their level of familiarity with English in general and SAE in specific (Campbell, 1996; van Keulen et al., 1998; Wyatt, 1998). To ensure that useful information will be gathered from informants, SLPs should develop and use instruments that (1) are user-friendly, (2) clearly specify or define behaviors that are to be rated or described, (3) are sensitive to the unique cultural differences and practices of the child, (4) are sensitive to different linguistic styles and behaviors, (5) are easy to complete, (6) are not time-consuming, and (7) elicit information that is pertinent and essential for the appropriate identification and diagnosing of language differences and deficits (Darley & Spriestersbach, 1978; van Keulen et al., 1998; Wyatt, 1998).

When appropriate modifications and adaptations are made to currently available language rating scale, checklist, and questionnaire procedures, they can be helpful in obtaining information about AAE preschool child speakers' linguistic development and their development in collateral areas. The following case example seems to underscore this point:

Case Study:

Jerry, a 4.10-year-old African American male preschooler, was referred by his teacher, Ms. Brown, to the Early Intervention Center for a language evaluation. Ms. Brown was concerned that Jerry was not expressing himself like most of the other children in her class. She felt that Jerry's language skills were not appropriate for his chronological age. With Jerry's mother's permission, the SLP at the Early Intervention Center mailed Ms. Brown the "Child Development Inventory: Teacher's Observation Guide" checklist (Ireton, 1995) and asked her to complete it. The

checklist allows teachers and caregivers to identify strengths and weaknesses in children's social, self-help, gross motor, fine motor, and language skills and behaviors who are between the ages of 1 and 6 years. The SLP also sent supplemental questions to Ms. Brown that allowed her to explain/describe how Jerry's language and communication skills were similar or dissimilar to his peers of the same cultural/linguistic background. It was the SLP's view that Ms. Brown's responses on the checklist and to the supplemental questions would assist him in determining if Jerry was displaying a language or communication skills characteristic of a language difference or language disorder. The supplemental questions included the following:

(1) Describe how the child usually communicates with his/her peers and with you in the classroom? In other settings (e.g. playground, lunchroom)?
(2a) What does the child do when his/her conversational partner(s) don't understand him/her?
(2b) What does the child do when he/she doesn't understand his/her conversational partners?
(3) Are the child's language skills similar to the language skills of other African American children in your class? If yes, explain how his/her language skills are similar. If no, explain how his/her language skills are different.
(4) When are the child's language and/or communication problems most noticeable to you?
(5) Overall, how do you rate the child's problems?
mild moderate severe profound

Ms. Brown's responses on the "Child Development Inventory" indicated to the SLP that Jerry's social, self-help, gross and fine motor abilities, and overall language skills were developmentally appropriate for his chronological age. However, Ms. Brown's responses to the supplemental questions suggested that Jerry's language patterns were different from those produced by his SAE speaking peers, but not substantially different from those produced by his African American peers who spoke AAE. In comparison to the other AAE child speakers in his class, Jerry was described as only producing AAE features more frequently. Therefore, the clinician posited that Jerry was exhibiting a language difference. He asserted, however, that additional language assessment procedures and analyses needed to be conducted before conclusive statements could be made regarding Jerry's dialect status or possible language deficits.

Additional Rating Scales That Can Be that Can Be Used with AAE Preschool Child Speakers

A rating scale that can be used by SLPs and that has been shown to be effective in identifying the dialect status of African American children is Wyatt's (1991) African American English Rating Scale (Wyatt, 1996). Her rating scale, which ranges from "1" (heavy usage of AAE features) to "7" (no evidence of AAE feature usage), allows clinicians to rate African American children's degree of AAE feature usage. By completing the scale prior to initiating a comprehensive language evaluation with an African American child, clinicians can acquire valuable, preliminary information about the child's linguistic skills, which can then be used to assist in the selection of additional assessment instruments and procedures that are appropriate, valid, and reliable for characterizing the unique linguistic abilities of AAE preschool child speakers.

General Limitations of Descriptive Language Assessment Procedures

As with many formal language assessment procedures, the limitations of some descriptive language assessment procedures can diminish their overall usefulness and effectiveness as diagnostic tools for determining linguistic and communication abilities and deficits of preschool children. Limitations can become more noticeable when procedures developed for SAE preschool child speakers are used to evaluate the linguistic and communication abilities of AAE preschool child speakers.

Limitations of descriptive language assessment procedures when used with AAE preschool child speakers will vary depending on various factors, including the type of procedure used (e.g., probe procedure; behavioral sampling procedure; rating scale, checklist, or questionnaire procedure) and the type of information/data that the SLP is attempting to obtain and/or analyze. Some specific limitations of descriptive procedures that have been discussed elsewhere include: (1) The validity and reliability of some descriptive procedures can be negatively affected by extraneous variables like examiner characteristics (e.g., linguistic style, ethnic background; chronological age), task demands, and stimuli presentation formats; (2) The administration time and data analysis procedures of some descriptive procedures can be time-consuming and laborious; (3) Some descriptive procedures require SLPs, caregivers, and other professionals to observe linguistic and communication behaviors that have not been clearly identified or described in the literature; (4) Normative or developmental data are not available regarding the acquisition or mastery of many linguistic features produced by AAE child speakers, which can preclude clinicians from comparing an individual AAE child's performance to the performance of other AAE child speakers of the same cultural background, chronological age, or socioeconomic status; and (5) Some descriptive procedures require clinicians to make subjective judgements about children's language skills, which could potentially affect the overall reliability of the procedure (Cole, Mills, & Dale, 1989; Craig, 1996; Haynes & Pindzola, 1998; van Keulen et al., 1998). Clinicians who are knowledgeable of the previously stated limitations and others are better able to select procedures that are appropriate for assessing the linguistic abilities of AAE preschool child speakers.

Benefits and Best Practice for Using Descriptive Language Assessment Procedures

As the number of African American English (AAE) preschool child speakers with language deficits on the caseloads of speech-language pathologists (SLPs) rises with increases in the general population of African Americans (AA) in the U.S., clinicians should use a variety of descriptive language assessment procedures (e.g., language sampling, elicitation tasks, questionnaires, rating scales) to obtain valid and reliable information about the children's abilities (Adler, 1992; Campbell et al., 1992; Campbell & Taylor, 1992; Cole, 1989). The benefits of using descriptive language assessment procedures when evaluating the linguistic abilities of AAE preschool child speakers can not be overemphasized.

SLPs can use descriptive language assessment procedures to assist them in differentiating language differences from language disorders in AAE preschool child speakers. Descriptive

procedures can also be used to gather detailed information about AAE preschool child speakers' linguistic skills when they participate in different activities and tasks, in different settings (e.g., home, community, classroom), and with a variety of conversational partners (e.g., caregivers, teachers, peers). In addition, descriptive procedures can be used to document changes in AAE preschool child speakers' communication and linguistic behaviors over time as they participate in speech-language pathology and other services in public school systems. Information gathered should assist clinicians in developing appropriate clinical and academic services, modifying speech-language intervention goals, and designing service delivery models that best meet the needs of AAE preschool child speakers and their families.

"Best practice" for using descriptive language assessment procedures to evaluate the linguistic abilities of AAE preschool child speakers' would suggest the following:

(1) A variety of descriptive language assessment procedures should be used during speech and language evaluations of AAE preschool child speakers' linguistic abilities. No single procedure is adequate for distinguishing language differences from language disorders in AAE preschool child speakers.

(2) AAE preschool child speakers' linguistic abilities should be evaluated in a variety of situations, with a variety of stimuli, and with different conversational partners/examiners. Their verbal and nonverbal performances can be affected by different situational contexts, stimuli, and conversational partner/examiner characteristics.

(3) Clinicians should be knowledgeable of linguistic features that are contrastive (e.g., copula usage) and noncontrastive (e.g., prepositions, conjunctions, articles) between AAE and SAE to prevent the over identification of AAE preschool child speakers who are using legitimate AAE features rather than exhibiting linguistic features and patterns characteristic of a language deficit.

(4) Clinicians should closely examine norms associated with different descriptive procedures and analysis techniques before using them to determine if African American (AA) preschool children, in general, and African American English preschool child speakers, in particular, were represented in the normative samples. Caution should be exercised when using norms that do not reflect the linguistic abilities of AA children or AAE preschool child speakers.

(5) Clinicians and other professionals should be mindful that AAE preschool child speakers' verbal and nonverbal performances frequently reflect their linguistic and cultural backgrounds. They should also realize that AAE preschool child speakers' come from different linguistic and cultural backgrounds and that their values, customs, and beliefs can be different from their peers, even when they are from the same linguistic or cultural background. Therefore, AAE preschool child speakers' performances and behaviors that are observed using descriptive language assessment procedures should be evaluated and interpreted from the perspective of the children's unique linguistic and cultural backgrounds, not only from the perspective of the clinician's cultural and linguistic background.

(6) Caregivers and other professionals (e.g., teachers, classroom assistants, nurses, physicians, learning specialists) who are involved in the overall development of AAE child speakers' language, cognitive, physical, and socioemotional skills should be consulted throughout the evaluation of linguistic abilities of AAE preschool child speakers. They can provide useful information to clinicians about AAE preschool child speakers' verbal and nonverbal behaviors and their development in other collateral areas.

(7) Information about AAE preschool child speakers language abilities should be obtained from caregivers and other professionals using language rating scale, checklist, or questionnaire procedures and through interviews.

(8) Clinicians should present their findings of AAE preschool child speakers' linguistic abilities in diagnostic reports in a manner that is sensitive and fair to the children's linguistic and cultural backgrounds. Linguistic behaviors that reflect language differences versus language disorders during the evaluation process should be clearly stated and described. In addition, selected examples of the children's linguistic behaviors that reflected language differences and language disorders should be included in reports when appropriate.

Future Directions

In the future, clinicians and researchers should continue to investigate AAE preschool child speakers' comprehension and productions of different AAE linguistic features. They should also continue to investigate the abilities of AAE preschool child speakers to codeswitch between AAE and Standard American English (SAE) when they are speaking in different situations and settings with different conversation partners and when they are engaged in a variety of tasks and activities. In addition, they should continue to investigate the affects of various factors, such as the children's characteristics (e.g., age, gender, culture, socioeconomic levels), the examiner's characteristics (e.g., age, gender, culture, dialect status), the task type and complexity (e.g., dialogue, narration, imitation), and the evaluation setting (e.g., home, clinic, classroom, playground), on African American (AA) children's usage of AAE features.

Clinicians and researchers should continue to develop descriptive language assessment procedures and analysis techniques that can accurately identify and differentiate linguistic features produced by AAE preschool child speakers that are characteristic of AAE from those that are reflective of a language deficit. Furthermore, the reliability and validity of existing descriptive language assessment procedures and analysis techniques developed for gathering information and for describing the language skills of SAE preschool child speakers need to be further investigated to establish their usefulness when used with AAE preschool child speakers with and without language deficits.

Clinicians who have had limited to no academic coursework or clinical training and experiences in selecting and administering language assessment procedures and analysis techniques, including descriptive language assessment procedures and analysis techniques, that are appropriate for evaluating the language skills of AA children, in general, and AAE preschool child speakers, in particular, should participate in continuing education programs and other activities (e.g., in-services, short courses, institutes, workshops, colloquiums) that provide them with information and skills for evaluating and managing AA children with language differences and disorders (American Speech-Language-Hearing Association, 1987; Campbell, Brennan, & Steckol, 1992; Campbell & Taylor, 1992). Graduate students enrolled in Communication Disorders training programs across the United States should be offered and should be required to take coursework that exposes them to normal and abnormal

communication development across the life span of people from culturally and linguistically diverse (CLD) backgrounds. Furthermore, they should be exposed to values, traditions, customs, beliefs, and practices of people from CLD backgrounds that could affect their participation and involvement in speech-language and other related services, and they should study language assessment procedures and analysis techniques that have been shown to be valid and reliable for evaluating AA children with language differences and disorders (Campbell et. al, 1992; Campbell & Taylor, 1992; Rivers, 2000). They should also be given a variety of clinical experiences that provide them with opportunities to evaluate and treat children from CLD backgrounds, in general, and AAE preschool child speakers, specifically (Campbell et. al, 1992; Campbell & Taylor, 1992).

With appropriate academic and clinical training in assessing and treating AAE preschool child speakers with and without language disorders and with increased knowledge of descriptive language assessment procedures and analysis techniques that are valid and reliable for evaluating AAE preschool child speakers' language strengths and weaknesses, speech-language pathologists should be better able to accurately identify and describe the unique language needs and concerns of AAE preschool child speakers and their families. Moreover, they should be able to develop more appropriate language assessment procedures and instruments for evaluating AAE preschool child speakers and more service delivery models and services for meeting the needs of AAE preschool child speakers and their families.

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Format Frequency Differences in Vowels Produced by African-American and Caucasian Male Speakers

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ABSTRACT: *Ten male African-American and ten male Caucasian-American speakers were recorded while reading 54 single syllable words. The words included the three voiceless stop consonants of English, /p/, /t/, /k/, and the three voiced stop consonants, /b/, /d/, /g/, preceding the vowels, /i/, /a/, /u/. A Linear Predictive Coding (LPC) computer program was used to extract first and second formant frequencies at the midpoint of the vowel for each of the words. The fundamental frequency was also measured at this point in the word. A significant difference was observed between the two speaker groups for each of these three acoustic measures. The potential sources for these differences were also discussed.*

KEY WORDS: *formants, fundamental frequency, racial background*

Introduction

Several studies of the acoustical parameters of speech produced by African-American speakers have focused on vocal fundamental frequency (Fo) (Hollien & Malcik, 1962; Hudson & Holbrook, 1981, 1982). These studies compared the Fo of African-American (AA) speakers to that of Caucasian-American (CA) speakers. The results of these studies revealed a lower Fo for the AA speakers than for their CA counterparts, for both male and female speakers.

Mayo and Manning (1994) also compared the Fo of AA speakers to CA speakers. In addition, these researchers also investigated possible formant frequency differences between the two speaker groups. This study revealed F1 and F3 to be significantly lower ($p < .05$) for the AAs, with a difference of approximately 4% and 7% respectively. There were no significant differences for the fundamental frequency and F2. Mayo and Manning (1994) suggested that "these differences should be taken into account during acoustic assessment of vocal function in AA male speakers" (p. 33).

Mayo and Grant (1995) compared several acoustic measures of AA and CA males. The acoustic parameters assessed were: 1) mean fundamental frequency (Fo), 2) jitter, 3) shimmer, 4) signal-to-noise ratio, and 5) the first three formant frequencies (F1, F2, F3). Average fundamental frequency, jitter, shimmer, and signal-to-noise ratio did not result in significant differences between the two groups.

These findings contrasted with results found by Walton and Orlikoff (1994) concerning jitter, shimmer and signal-to-noise ratio, but are in agreement with regard to Fo. Mayo and Grant (1995) also found statistically significantly lower vowel formant frequencies for the AA subjects. F1, F2, and F3 were 4%, 2%, and 5% lower, respectively. Lass, Tecca, Mancuso, and Black (1979) investigated listeners' accuracy in identifying AA and CA speakers. Listeners were able to identify the speakers' ethnic backgrounds with 58% accuracy from isolated vowel productions alone.

Vowel formant frequencies can be employed to document changes due to speech therapy for disorders ranging from hearing-impairment (Ryalls, Michallet & Le Dorze, 1994) to dysarthria (Weismer, 1980). However, clinicians serving culturally and linguistically diverse populations may have difficulty finding comparative data since previous studies have mostly focused on Caucasian speakers (e.g. Peterson & Barney, 1952; Hillenbrand, Getty, Clark & Wheeler, 1995).

The present study was designed to explore whether separate comparative measures of formant frequencies are needed for AA and CA male speakers. In addition, the fundamental frequencies were measured in both speaker groups. Multiple real word productions were employed in this study instead of the

sustained isolated vowel productions used in previous studies (Mayo & Grant,1995; Mayo & Manning, 1994).

Method

Twenty male subjects, composed of ten AAs and ten CAs, were recruited from the student body and staff of the University of Central Florida. Subjects were excluded from the project if they had a history of asthma, allergies, or smoking as well as speech-language problems and/or hearing loss. Only native speakers of English, between the ages of twenty and thirty years were recruited for the study in order to eliminate the influence of foreign accent or age.

The speech samples were recorded in an Industrial Acoustic Company (IAC) sound-treated booth. Recordings were acquired on a Sony TCD-D3 Digital Audio Tape (DAT) recorder with a Sony ECM-909 microphone. The microphone was positioned approximately six inches from the speaker's mouth.

The real word utterances included the three voiceless stop consonants of English (/p/, /t/, /k/) and the three voiced stop consonants (/b/, /d/, /g/) preceding the peripheral vowels, /i/, /a/, /u/. These particular vowels represent maximal differences in the relationship of tongue placement. The stimuli were presented in the form of CV and CVC monosyllabic words five times each, in random order within a repetition set. These stimuli are presented in Table 1.

Table 1. Speech stimuli

	/p/	/t/	/k/
/i/	pea	tea	key
/a/	pot	tot	cot
/u/	poo	too	coo
	/b/	/d/	/g/
/i/	bee	Dee	gee
/a/	bog	dot	got
/u/	boo	do	goo

The Barus Laboratory Interactive Speech System (BLISS) computer program was used to perform the acoustic analyses. Speech stimuli were sampled at 10 kHz with 12 bit quantization, after low-pass anti-alias filtering at 4.9 kHz.

Fundamental frequencies and formants were measured from the mid-point of the vowel. Linear Predictive Coding (LPC) was used to extract the first two formant frequencies from each record (Kent & Read, 1992), while the fundamental frequency was determined by the average of ten periods in the middle of the vowel, isolated from the raw waveform.

Interjudge and intrajudge reliability were calculated using the Pearson product moment coefficient of correlation. Interjudge reliability was determined by comparing the original investigator's data analysis for a randomly selected subject to analysis of the same subject by a different investigator. The Pearson correlation coefficient on average measures was .89. Intrajudge reliability was examined by comparing initial measures of a randomly selected subject to a re-measure of the same subject by the examiner. The Pearson correlation coefficient for intrajudge reliability was .92.

Results

Average values and standard deviations for the acoustic measures for each group are presented in Table 2. As can be seen in Table 2, the mean F1 for AA speakers was lower for /a/ and /u/ than the same measure for the CA speakers. However, this was not the case for the production of /i/, where the two speaker groups had similar values. F1 variation was higher in the AA group, which is reflected in higher standard deviations.

Table 2. Means and standard deviations (in parentheses) for F1

	/i/	/a/	/u/
AA	309 Hz (52 Hz)	693 Hz (110 Hz)	339 Hz (43 Hz)
CA	308 Hz (37 Hz)	758 Hz (76 Hz)	353 Hz (34 Hz)

F2 results, which are presented in Table 3, were similar to those for F1. The AA speakers produced lower F2 frequencies for two of the vowels (/i/, & /u/). The CA speakers had a lower average F2 for /a/. However, this difference was not as substantial as for the /i/ and the /u/ vowels. Again, the standard deviations were higher for the AA speakers.

Table 3. Means and standard deviations (in parentheses) for F2

	/i/	/a/	/u/
AA	2124 Hz (409 Hz)	1279 Hz (192) Hz	1328 Hz (321 Hz)
CA	2223 Hz (273 Hz)	1245 Hz (143 Hz)	1490 Hz (308 Hz)

Finally, the CA speakers were found to have lower Fo averages across all three vowels, as shown in Table 4. These findings conflict with earlier studies that reported a lower Fo for AA speakers than CA speakers for sustained isolated vowels (Hollien & Malcik, 1962; Hudson & Holbrook, 1980, 1981). As in the case of other measures, the standard deviation of the Fo for the AA speakers was greater than that for the CAs.

An Analysis of Variance (ANOVA) was used to test the statistical significance of these differences. The results of the ANOVA

Table 4. Means and standard deviations (in parentheses) for Fo

	/i/	/a/	/u/
AA	134 Hz (24 Hz)	127 Hz (20 Hz)	134 Hz (25 Hz)
CA	111 Hz (17 Hz.)	107 Hz (15 Hz)	116 Hz (17 Hz)

revealed a significant difference between AA speakers and CA speakers on all three dependent variables (Fo, F1, and F2). That is, a significant F-ratio was observed for all three ANOVA treatments. The AA speakers had a significantly lower F1 than the CA speakers [$F(1, 1075) = 43.964$, $p < .0001$]. The AA group also had a lower F2 than the CAs [$F(1, 1055) = 18.356$, $p < .0001$]. The greatest difference between the two speaker groups was observed for the fundamental frequency [$F(1, 1078) = 284.360$, $p < .0001$]

The number of total measures did not reach 1080 for the ANOVA's even though this was the intended number of measures for each of the dependent variables. This was because a handful of measures could not be recorded due to incorrect production by the speaker, or a measure was not obtained due to unstable formant productions at the midpoint of the vowel.

With regard to interaction effect of racial background by vowel, a significant F-ratio was observed for F1, [$F(2, 1075) = 25.922$, $p < .0001$] and F2, [$F(2, 1055) = 10.447$, $p < .0001$]. This was not the case for Fo, for which the interaction effect did not reach the level of statistical significance [$F(2, 1078) = 1.477$, $p = .229$]. Naturally, there was an enormous difference between the vowels for F1 and F2. This was expected because each vowel has its' own prototypical formant values and somewhat different inherent fundamental frequencies (Peterson & Barney, 1952). A significant difference for Fo between the vowels, [$F(2, 1078) = 15.067$, $p < .0001$] was also revealed.

Discussion

The present study was implemented in an attempt to further explore formant frequency differences previously found between African-American speakers and Caucasian-American male speakers. Fundamental frequency differences were also investigated.

The results of this study are in general agreement with earlier investigations of first and second formant frequency differences between AA male and CAs. Mayo and Manning (1994) found F1 of the /a/ vowel to be significantly lower ($p < .05$) for AA speakers than for CA speakers. They also found AAs to have lower F2. However this latter difference was not statistically significant in this study. Mayo and Grant (1995) found AA speakers to have lower F1 and F2 than CAs. In the present investigation, these differences reached statistical significance for both formants (F1, $p < .0001$; F2, $p < .0001$). The present study revealed somewhat greater differences in formant frequencies between the two speaker groups. This difference was greater for the first formant than the second formant.

Kent and Read (1992) have pointed out that F1 and F2 are related to resonances in the pharyngeal and oral cavity respectively. It is essentially the size of these cavities that determines the magnitude of F1 and F2. However, it should be pointed out that many other factors can influence formant frequencies. These factors include rounding of the lips and constrictions near the larynx.

In light of this information, several possible explanations for F1 and F2 differences between the AA and CA speakers are possible. The following is a discussion of possible formant frequency differences based on racial background.

The first possible explanation is that the AA subjects could have, on the average, a longer vocal tract. This would largely account for lower F1 and F2 because a larger resonating cavity typically results in a lower resonating frequency. However, the relevant studies to test such a hypothesis have not been carried out.

Another possible explanation for such formant frequency differences could be related to dialect-based differences in articulation. This would mean that the two speaker groups could have slightly different ways of producing the same vowel. Again, F1 and F2 are mainly determined by tongue placement. Therefore, a difference in articulation would probably be realized in one lower and one higher formant frequency for either speaker group. This is because tongue placement largely determines the size of both pharyngeal and oral cavities.

Finally, a possible explanation is that AA speakers may not attain velopharyngeal closure as consistently as their CA counterparts. Such a difference could suggest that AA speakers have somewhat more nasalized vowel productions. In fact, eight of the ten AA speakers who participated in the study had considerable F2 lowering for some of the vowel productions. That is, a distinctly lower second formant frequency was observed in many cases. It is possible that this downward shift for F2 would be present if velopharyngeal closure was not fully achieved. Mayo, Floyd, Warren, Dalston, and Mayo (1996) reported similar nasalance scores between AA and CA speakers in oral reading of short passages containing few nasal phonemes. However, in readings of sentences with many nasal sounds, CA speakers had significantly higher nasalance scores than the AA speakers (Leeper, Rochet, MacKay, 1992). These data suggest that nasalization does vary significantly as a function of speaker or dialect.

The finding of significantly lower fundamental frequency in CA speakers is not in agreement with some of the earlier studies (Hudson & Holbrook, 1981, 1982). Mayo and Manning (1994) and Mayo and Grant (1995) did not find a significant difference for fundamental frequency between the two speaker groups. A possible difference between the present study and the previous studies mentioned could be attributed to the differences in speech stimuli. Hudson and Holbrook (1981, 1982) extracted the fundamental frequency from speakers' conversations and oral readings. Mayo and Manning (1994) and Mayo and Grant (1995) measured the fundamental and formant frequencies from sustained /a/ vowel productions. Whether or not this difference in methodology can account for such a difference in Fo is an area for further investigation.

It is important that future research employ a greater number of subjects to improve sample representations of the population. Eventually, separate F1 and F2 norms for each speaker group may be required. Results obtained in the present study were similar to earlier work in this area (Mayo & Manning, 1994; Mayo & Grant, 1995). Ryalls, Zipprer & Baldauff (1997) also found significant differences in the production of Voice Onset Time (VOT) as a function of the racial background of speakers.

Additional research should investigate precisely what factors account for the different F1 and F2 values found between

AA and CA speakers. Further studies are needed to provide normative data for formant frequencies that consider racial background. Such data are important since formant frequency measures are one means of assessing the effects of various speech disorders.

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The Consistency of Kay Elemetrics Multidimensional Voice Program (MDVP) for the Acoustic Analysis of the Dysphonic Voice

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ABSTRACT: *Acoustic measures are commonly used in voice clinics and laryngeal function laboratories for evaluating the frequency, amplitude and timing of normal as well as disordered voice characteristics. Acoustic data is used for documenting treatment outcomes, determining sound source characteristics, and establishing correlation with perceptual judgments. This quasi-experimental, multiple measure study examined the intra-system (across measurement days) and intra-analyst (across measurement trials) consistency of The Kay Elemetrics Multidimensional Voice Program (MDVP) through the analysis of sustained vowel samples. Six patients with dysphonia, three perceptually judged as having mild hoarseness and three perceptually judged as having severe hoarseness, were the subjects of the study. A control group, consisting of three subjects with no vocal disturbance, was also examined. A sustained vowel /Ψ/, produced at a comfortable pitch and loudness, was acoustically analyzed six times on two measurement sessions one week apart by one analyst for each of the severity categories of the dysphonia. Dependent variables included fundamental frequency, jitter, shimmer, and noise- to-harmonic ratio. Findings indicated no significant change in all dependent variables for the mildly hoarse and the severely hoarse voices across measurement day or measurement trial.*

KEY WORDS: *pathological voice, MDVP, fundamental frequency, jitter, shimmer, noise to harmonic ratio*

Introduction

Acoustic analysis programs have become an integral tool for examining both the normal and the disordered voice (Baken & Orlikoff, 2000). Voice therapists and speech scientists use these programs as important procedures for the evaluation of treatment outcomes and for documenting sound source characteristics.

Quantification of perceptual findings has been a very important issue for both clinicians and voice scientists. Computer-based acoustic analysis is needed to support and complement perceptual findings. Acoustic analysis systems, such as the Kay Elemetrics Multidimensional Voice Program (MDVP), provide a window of opportunity to do just that. MDVP is a software option for the Computerized Speech Lab (CSL). This option provides the ability to analyze sustained vowel samples, as well as continuous speech. The reliance on acoustic digitization systems, such as MDVP, should not imply that perceptual assessment of voice disorders is dispensable as it relates to research and clinical practice. In fact, even with the availability of new quantification techniques, perceptual evaluation is still needed since it is robust, convenient and useful (Kent, 1996). However, perceptual judgments may not be accurate enough for making clinical or therapeutic decisions as the margin of error could be large, and may not be tolerated. Provided that the hardware and software associated with acoustic analysis systems proves to be reliable, these systems can reduce human error by providing quantification through data rather than completely relying on subjective perceptual judgments of vocal quality (Kent, Vorperian & Duffy, 1999). Investigating the consistency of these systems contributes to refining their future design (Read, Buder, & Kent, 1992).

Although the issue of consistency of acoustic analysis programs is very important, the manuals of many programs do not

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include results of consistency testing. A recent study of the intrajudge and interjudge consistency of the MDVP program was conducted by Cimino and Sapienza (1999). Their results showed MDVP to be a stable and reliable assessment tool for the examination of normal voice. However, investigating the consistency of MDVP measurements for quantifying the disordered voice presents new challenges. The aperiodicity of the disordered voice may result in inconsistent analyses and, as a result, misleading results (Baken & Orlikoff, 2000; Titze, 1991). It is well known that the measurement of fundamental frequency, jitter and shimmer rely on tracking the period of vibration. In voice disorders, the period of vibration may not be stable, therefore the system may not track it accurately. The resulting data may be erroneous leading to error in data reporting and interpretation.

Several studies have been conducted to address the capabilities as well as the limitations of different available speech analysis systems. Read, Buder and Kent (1990) surveyed five speech analysis programs, CSpeech (Milenkovik, 1986, Madison, WI), Canadian Speech Research Environment, CSRE (Jamieson, London, Ontario), Interactive Laboratory System, ILS-PC (Signal Technology Inc., Goleta, CA), Micro Speech Lab, MSL (Software Research Corp., Victoria, BC) and MacSpeech Lab II (GW Instruments, Cambridge, MA). These systems were evaluated in terms of capabilities, requirements and user interface for each program.

In another study, Read, Buder and Kent (1992) also reviewed several speech analysis systems, the Kay Elemetrics Sonagraph Model 5500, MacSpeech Lab, and Signalyze in addition to those mentioned above. They addressed various aspects of the speech analysis systems such as selection, price and installation, availability of detailed, easy to read documentation, availability of technical help, speed efficiency, compatibility of data formats (i.e. transferability of data from one system to another) and data journaling. Read et al. (1992) also made an interesting comparison among the systems regarding the measurements of FFT and LPC spectra. They found that there were minor differences among the six systems in analyzing synthetic vowels. However, the question of accuracy among the different systems and within each system was not addressed. They did question the use of such systems to evaluate dysphonic voices and/or voices of women and children in terms of possible subtle failures in fundamental frequency tracking.

Bielamowicz, Kreiman, Gerratt, Dauer and Berke (1996) questioned the consistency of the measures indicating aperiodicity, i.e. frequency variability (jitter) and amplitude variability (shimmer), in three acoustic analysis systems, CSpeech, CSL and Soundscope. They measured perturbation (both frequency and amplitude cycle-to-cycle variability) within 50 voice samples produced by those with mild to severe dysphonia. They found significant differences in fundamental frequency, jitter and shimmer across the three speech analysis systems. However, the intraprogram consistency was not addressed because of the presumption that "computer-based algorithms will always produce identical results under identical conditions." (p.128). This presumption is not a safe one to make since algorithms may sometimes give different results (Kent et al, 1999). Also, the systems that Bielamowicz et al. (1996) examined allowed the user to change analysis settings for some of the measures. This means that if the settings for subsequent measures were changed, results would not be consistent.

Karnell, Scherer and Fischer's study (1991) also compared jitter and shimmer data across three analysis systems: the Visi-Pitch PC system and two other minicomputer systems. They measured sustained vowel /Ψ/ phonation in one male and one female with normal voice. Their results showed that the perturbation data obtained by the three systems could not be assumed to be comparable. They stated that the data could be affected by the analysis technique, including hardware characteristics, filtering and pitch period determination.

Recently, Kent et al. (1999) discussed the reliability of MDVP for the analysis of voice samples of 32 individuals with dysarthria of various etiologies. One of the concerns raised by the authors was the inability of MDVP to discriminate between various groups of disorders, and in particular, neurological disorders. Dysarthria was the main focus of the above-mentioned study because the authors believed that dysarthric vocal function is affected by several factors, including, sex, age, and compensatory strategies, which may create a great deal of variability in vocal function measurements. The focus of their study was to determine if MDVP would be a reliable instrument in the differential diagnosis of the various kinds of dysarthria. In addition, the study investigated the consistency for the analysis of the same signal, the consistency of users' editing process, and the trial-to-trial variability of MDVP analyses. The authors concluded that MDVP was indeed suitable for the analysis of voice samples from their heterogeneous group of dysarthrias. It was also found to be reliable for the analysis of the same signal, with the exception of the parameter called the degree of voiceless (DUV). This parameter showed errors for the dysphonic speakers that exceeded the normative data given in MDVP. As for the repeated edits, the analyses were, and should be, replicable provided that the users are consistent throughout the editing process. However, the authors warned that "some parameters appeared to be vulnerable to between-edits differences" (p.135). Examples of those were, the degree of voiceless (DUV), F0-tremor intensity index (FTRI), amplitude tremor intensity index (ATRI), fundamental frequency variation (vF0), and smooth pitch perturbation quotient (sPPQ). Trial-to-trial differences were found to be large, reflecting the inconsistent motor control typical of the vocal function of patients with neurological disorders. The authors stated that single trials may not be sufficient to evaluate vocal dysfunction in this population, and suggested using two or more trials. The authors concluded that MDVP is a consistent tool for the analysis of vocal function in neurogenic speech disorders. However, they cautioned against the use of MDVP to analyze the severely dysphonic voice.

The purpose of this study was to examine the intra-system and intra-analyst consistency of the Kay Elemetrics Multidimensional Voice Program (MDVP) for acoustic analysis of the disordered voice, namely mild and severely dysphonic voice with no organic pathology present on the vocal folds.

It was hypothesized that the MDVP system would produce consistent acoustic measures of fundamental frequency, jitter, shimmer, and noise to harmonic ratio across measurement day and measurement trial, regardless of the severity of the voice disorder.

Method

Subjects. This study utilized voice samples from patients' voices recorded earlier on digital audio tapes (DAT) at the University of Florida's Department of Otolaryngology. When a patient comes to the Department of Otolaryngology for a voice evaluation, a recording of their voice during production of sustained vowels and reading is made. At the time of the recording, patients are instructed to produce the vowel /Ψ/ at a comfort-

able pitch and loudness and sustain the vowel as long as possible. Three vowel samples are usually acquired. Sustained vowel samples from six patients, two males and three females, were used for the purpose of this study. Patients' ages ranged from 40-80 years. Three subjects were perceptually judged as having 'mild hoarseness' (age range 60-75 years) and three subjects were perceptually judged as having 'severe hoarseness' (age range 40-80 years). Two certified speech-language pathologists having five or more years of experience working with voice disorders completed the perceptual judgments. There was no disagreement between the judges on the level of vocal severity presented by the patients. This was the case since the distinctions between the mild and severe group were quite apparent. A 5-point severity scale was used to make the perceptual judgments, with 1 representing normal voice and 5 representing severely abnormal. A control group of three subjects was also examined to establish a baseline against which the categories of severity could be compared.

All recordings (both patients and controls) were made with a cardioid type unidirectional headset microphone (Isomax , Countryman Associates, Inc., CA) to ensure minimum noise levels while collecting the voice samples. A microphone-mouth distance of 2 cm was kept constant throughout the recordings. Videostroboscopic examinations of the patients' vocal folds were reviewed to ensure the absence of organic laryngeal pathologies on the vocal folds so as to limit the subject selection criteria to those with non-organic dysphonias. The patients were diagnosed as 'functionally dysphonic' by the practicing otolaryngologist in the outpatient ENT clinic at the University of Florida Medical Center. All patients had hoarseness as the major clinical sign and were referred for behavioral voice therapy. A review of the patients' medical history revealed no history of neurological pathology, no prior formal speech, voice, or singing training, and no cold, allergy, or flu symptoms at time of video and audio recording.

Equipment and Procedures

Voice samples were input to Kay Elemetrics Computerized Speech Lab (CSL) with MDVP software program via a SONY Digital Audio Tape Recorder (DAT, 60ES) to A/D board installed in the CSL hardware. The digitization rate was set at 25kHz. Antialiasing is an inherent feature to the CSL system, i.e. CSL automatically performs the appropriate anti-alias low pass filtering just below the Nyquist frequency. Each subject's entire sustained vowel /Ψ/ duration produced at a comfortable pitch and loudness level was digitized using MDVP software and analyzed on two different days, three times each, one week apart. Every subject's voice sample was measured a total of six times on two different measurement sessions by one analyst. Vowel productions from each subject were analyzed using the MDVP sustained phonation analysis. The mild dysphonic group had two males. Their average vowel length was 21 and 20 seconds respectively, (subject 1 = 21.47, 21.45, 21.38, subject 2 = 20.14, 19.73, 20.02). The female in the mild dysphonic group had an average vowel length of 16 seconds (Subject 3= 15.97, 16, 16). In the severely dysphonic group (all females), the average vowel length for subject 1 was 10 seconds (9.95, 9.90, 9.95), six seconds for subject 2 (6.44, 6.43, 6.45), and four seconds for subject 3 (3.93, 3.92, 3.95). In the control group (all females), subject 1 produced an average vowel length of 10 seconds (10.12, 10.32, 10.41), subject 2 also produced an average of 10 seconds (10.31, 9.51, 9.34), and subject 3 produced an average of 11 seconds (11.21, 10.97, 10.79).

The signals were trimmed to allow for analysis of the entire vowel. Input level was kept constant throughout the measurement trials using the CSL input control dial. Dependent variables included fundamental frequency, jitter, shimmer, and noise to harmonic ratio. Fundamental frequency is the lowest frequency component or the rate of repetition in a complex periodic wave (number of cycles the vocal folds vibrate per second). Intensity is the amount of pressure of a sound wave (Borden, Harris, & Raphael, 1994). Jitter is cycle-to-cycle frequency variability. Shimmer is cycle-to-cycle amplitude variability (Baken & Orlikoff, 2000; Titze, 1994). Noise to harmonic ratio refers to the periodic energy relative to noise energy in a speech signal, i.e. the ratio between signal energy and noise energy (Kent & Read, 1992).

Statistical Analyses

A two-tailed t-test, set at an alpha level /Ψ/ of .05 was used to measure differences in the dependent variables as a function of day of measurement. A repeated measures Analysis of Variance (ANOVA) was used to measure differences in the dependent variables consistency as a function of the six measurement trials.

Results

Table 1 shows the descriptive statistics of the acoustic measurements for the nine subjects of the study (3 controls, 3 mildly dysphonic, 3 severely dysphonic). Overall inspection of the descriptive data indicated a high general consistency across measurement trials as well as across measurement day. (See Table 1).

Although the data showed consistent fundamental frequency means as a function of measurement day and trial, the MDVP analyses of the severely dysphonic voices showed some slight discrepancies. For example, there was a difference between the mean fundamental frequencies measured for subject 2 (day 1 = 156.39 Hz, day 2 = 158.31 Hz, with a difference of 1.92 Hz). Subject 3 results also showed some discrepancy (day 1 = 189.97 Hz, day 2 = 192.25 Hz, with a difference of 2.28 Hz). These differences, however, were only on the order of a one percent error.

MDVP analyses for jitter in the severely dysphonic voice also showed differences as a function of day of measurement and trial. The percentage of error was similar to that found for fundamental frequency. The largest difference across measurement day was for subject 1. Day 1 measurement of jitter was 2.97% and Day 2 measurement was 2.76%. This difference was on the order of a one percent error.

MDVP analyses for shimmer, showed the largest discrepancies across the two measurement days for subject 3 in the mildly dysphonic voice samples (day 1= 3.12, day 2 = 3.74 Hz). This difference across measurement day was approximately a sixteen percent difference. No other large discrepancies were noted for subjects within the severely dysphonic group.

The data of noise to harmonic ratio across two different measurement days and trials showed consistent MDVP results for all subject groups.

The results of the statistical analysis indicated no significant mean differences in the dependent variables as a function of measurement day. A repeated measures design ANOVA followed

Table 1. Descriptive data of measurement trials across measurement days

Controls				Day 1					Day 2	
Subject 1	Measurement 1	Measurement 2	Measurement 3	Mean	Stdev	Measurement 1	Measurement 2	Measurement 3	Mean	Stdev
Fo	195.62	195.62	195.63	195.62	0.01	195.63	195.64	198.63	196.63	1.73
Jitt	0.48	0.50	0.48	0.48	0.01	0.49	0.49	0.39	0.46	0.06
Shim	2.18	2.18	2.23	2.20	0.03	2.22	2.25	1.91	2.13	0.19
NHR	0.12	0.12	0.13	0.12	0.00	0.13	0.13	0.12	0.12	0.00
Subject 2	Measurement 1	Measurement 2	Measurement 3	Mean	Stdev	Measurement 1	Measurement 2	Measurement 3	Mean	Stdev
Fo	198.67	198.67	198.66	198.67	0.00	198.64	198.67	198.63	198.64	0.02
Jitt	0.37	0.38	0.37	0.37	0.00	0.38	0.38	0.39	0.38	0.00
Shim	1.80	1.81	1.77	1.79	0.02	1.92	1.81	1.91	1.88	0.06
NHR	0.12	0.12	0.12	0.12	0.00	0.12	0.12	0.12	0.12	0.00
Subject 3	Measurement 1	Measurement 2	Measurement 3	Mean	Stdev	Measurement 1	Measurement 2	Measurement 3	Mean	Stdev
Fo	206.35	206.35	206.50	206.40	0.09	206.35	206.34	206.50	206.40	0.09
Jitt	0.61	0.61	0.64	0.62	0.02	0.61	0.61	0.65	0.63	0.02
Shim	3.79	3.81	2.99	3.53	0.47	3.77	3.75	2.99	3.50	0.46
NHR	0.13	0.13	0.14	0.14	0.00	0.13	0.13	0.14	0.14	0.00

MILD				Day 1					Day 2	
Subject 1	Measurement 1	Measurement 2	Measurement 3	Mean	Stdev	Measurement 1	Measurement 2	Measurement 3	Mean	Stdev
Fo	138.05	138.04	138.05	138.05	0.01	138.08	137.87	138.05	138.00	0.11
Jitt	2.84	2.77	2.80	2.80	0.03	2.94	2.83	2.88	2.88	0.06
Shim	6.68	6.64	6.69	6.66	0.03	6.38	6.66	6.67	6.57	0.16
NHR	0.16	0.16	0.16	0.16	0.00	0.17	0.17	0.16	0.17	0.00
Subject 2	Measurement 1	Measurement 2	Measurement 3	Mean	Stdev	Measurement 1	Measurement 2	Measurement 3	Mean	Stdev
Fo	166.62	166.23	166.66	166.50	0.23	166.66	166.66	166.64	166.65	0.01
Jitt	1.30	1.33	1.31	1.31	0.02	1.34	1.33	1.31	1.32	0.02
Shim	2.90	2.92	2.76	2.86	0.09	2.89	2.89	2.93	2.90	0.02
NHR	0.13	0.13	0.13	0.13	0.00	0.13	0.13	0.13	0.13	0.00
Subject 3	Measurement 1	Measurement 2	Measurement 3	Mean	Stdev	Measurement 1	Measurement 2	Measurement 3	Mean	Stdev
Fo	206.84	206.84	206.84	206.84	0.00	206.84	206.82	206.84	206.83	0.01
Jitt	0.56	0.58	0.56	0.57	0.01	0.59	0.59	0.56	0.58	0.02
Shim	3.12	3.12	3.11	3.12	0.01	3.11	5.00	3.11	3.74	1.09
NHR	0.10	0.10	0.10	0.10	0.00	0.10	0.10	0.10	0.10	0.00

SEVERE				Day 1					Day 2	
Subject 1	Measurement 1	Measurement 2	Measurement 3	Mean	Stdev	Measurement 1	Measurement 2	Measurement 3	Mean	Stdev
Fo	162.19	161.41	161.48	161.69	0.44	161.75	161.5	161.48	161.58	0.15
Jitt	3.03	3.01	2.89	2.97	0.08	2.78	2.84	2.66	2.76	0.09
Shim	6.22	6.5	6.49	6.4	0.16	6.23	6.36	6.3	6.3	0.07
NHR	0.15	0.16	0.16	0.16	0.01	0.15	0.15	0.15	0.15	0.00
Subject 2	Measurement 1	Measurement 2	Measurement 3	Mean	Stdev	Measurement 1	Measurement 2	Measurement 3	Mean	Stdev
Fo	158.72	154.37	158.08	156.39	1.88	158.22	158.55	158.16	158.31	0.21
Jitt	4.00	5.25	3.85	4.37	0.77	4.11	4.27	4.09	4.16	0.10
Shim	5.54	5.90	5.37	5.60	0.27	5.23	5.58	5.73	5.51	0.26
NHR	0.24	0.27	0.23	0.25	0.02	0.26	0.25	0.25	0.25	0.01
Subject 3	Measurement 1	Measurement 2	Measurement 3	Mean	Stdev	Measurement 1	Measurement 2	Measurement 3	Mean	Stdev
Fo	192.92	187.04	189.94	189.97	2.94	193.59	189.43	193.73	192.25	2.44
Jitt	4.45	3.72	4.07	4.08	0.36	4.09	4.09	4.04	4.07	0.03
Shim	8.01	6.92	7.43	7.45	0.55	7.66	7.08	7.66	7.46	0.34
NHR	0.22	0.20	0.17	0.20	0.02	0.17	0.21	0.16	0.18	0.03

up by the Huynh-Feldt post-hoc follow up test (most conservative) was utilized. This follow up test is routinely reported with repeated measures ANOVA to correct for the violation of the sphericity assumption (equal variance and covariance). Results showed no significant differences in the dependent variables as a function of measurement trial.

Conclusion

The use of acoustic measurement of the human voice is common among speech-language pathologists. Acoustic measures are relied upon, along with perceptual judgments of vocal characteristics, in the process of clinical and scientific decision making. Computer-based acoustic analyses, however, may have inherent limitations and shortcomings. Hence, the continuous testing of acoustic analysis devices is needed to recognize the potential subtle shortcomings of computer programs and to minimize the effects of these shortcomings. Clinicians need to feel comfortable that the clinical decisions they make based upon computerized acoustic data analyses, along with their perceptual judgments, are valid. Part of defining validity of a measure is defining the consistency of the measure or the techniques used to make the measure. Likewise, voice scientists need to integrate error margins, if any, into their research results.

This study investigated the consistency of the MDVP for acoustic analyses of the dysphonic voice in an effort to complement previous studies that investigated the consistency of MDVP for the acoustic analysis of the normal voice (Cimino & Sapienza, 1999) and the dysarthric voice (Kent et al., 1999). Both studies recognized the necessity of testing the consistency of MDVP for the acoustic analysis of the dysphonic voice and recommended its investigation. This study came as a response to these recommendations taking the issue of confirming MDVP consistency one step further. The data of this study revealed that, regardless of the severity of voice, the MDVP system showed high degree of consistency (i.e. intra-system and intra-analyst consistency).

Based on Cimino and Sapienza's work (1999), Kent et al.'s (1999) study and this study, it appears that MDVP's acoustic analyses for normal, dysarthric and functional (non-organic) voice dysphonias are reliable. This has important implications as it supports the potential use of this system for documenting treatment outcomes. Training and skill of the analyst, however, will always be a criterion for ensuring intra-analyst consistency. Clinicians might want to consider collecting a representative sample (10%) of analyzed voice samples to demonstrate consistency of their measurements. Or they may want to acknowledge databases such as this or others to support their case for why they are engaging in the acoustic analysis of their patients' voice.

Limitations and Future Work

The results were based on a small number of patients, and these patients did not have any observable pathology on their vocal folds. It would be interesting to implement the same methodology and procedures on organic voice disorders and/or spasmodic dysphonia to determine MDVP's ability to accurately track and measure acoustic events such as subharmonics, increased episodes of aperiodicity and/or fundamental frequency shifts.

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Successful Educational Re-Entry After Severe Traumatic Brain Injury: The Contribution of Cognitive Compensation Strategies

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ABSTRACT: *This study examines the educational performance of 51 high school and college students with severe traumatic brain injuries. They were trained in compensatory strategies for memory, executive, and other cognitive deficits for one to four months prior to school re-entry. Most students who participated fully in the program, or who had family members who participated fully, were placed directly in mainstream classrooms and achieved grades comparable to or better than those earned before injury. This outcome was achieved across all levels of coma, post-traumatic amnesia, and measured cognitive impairment, and across all locations for focal brain lesions. These results suggest that consistent use of the cognitive rehabilitation compensatory techniques is sufficient to produce a good education recovery.*

KEY WORDS: *mainstream, education, traumatic brain injury, head injury, high school, college, amnesia, coma, memory, executive, school re-entry, cognitive deficits, rehabilitation, compensatory techniques, family, recovery.*

Introduction

This study reports on the academic outcomes for a sample of high school and college students who sustained closed head injuries, received intensive cognitive rehabilitation, and were then followed to assess their functioning in school. The techniques employed in their rehabilitation were developed across a period of more than thirty years for a mixed adult and adolescent population, and this is the first outcome study concerning the efficacy of this rehabilitation in restoring academic functioning.

The high school or college student returning to school after a serious traumatic brain injury faces a difficult, if not desperate, situation. The injury has struck at the very heart of his or her academic skills: Reduced information processing efficiency means that assignments are missed, material studied in the normal manner is frequently forgotten, and attempts to apply what can be recalled are frequently ineffective. In effect, the student is a weaker and slower learner, less able to use what he or she has learned, and less able to manage the time and effort needed for learning. These permanent deficiencies in learning (Lehr, 1990) and in output-management or executive skills (Ylvisaker and DeBonis, 2000) are recognized as the effects of traumatic brain injury most destructive to the attempt to return to school.

Parents and school personnel likewise face a difficult, if not a desperate, situation. Equipped with very little knowledge about traumatic brain injury, lulled initially into a false sense of security by the student's rapid early progress and normal superficial appearance, they soon become confused, then concerned, and too often stymied by the emerging academic difficulties (Shurtleff et al., 1995). Unaware of the unique needs created by this injury, they turn to the special education system for learning disability, only to discover that test results are misleading and educational interventions often ineffective for traumatic brain injury (Rourke et al., 1983).

Longitudinal studies of recovery from pediatric head injury demonstrate that academic decline is quite common and persistent in this population, particularly for children with severe injuries (Ewing-Cobbs et al., 1985; Telzrow, 1987). Rutter et al. (1983) suggest a threshold level of one week of post-traumatic amnesia (roughly equivalent to one to two days of coma, characterized by most investigators as a very severe injury) for serious cognitive and academic sequelae in children. Levin (1987)

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reports that impairment is likely to be permanent for patients in coma for more than 24 hours, with "less than one chance in five that the patient's cognitive functions will improve (over time) to a normal level."

The incidence of school-related problems, including retention in grade, decline in grades, and teacher rating of reduced academic performance, varies with the severity of the injury, ranging from 33% for a mild sample (more than half did not lose consciousness and only 10% were unconscious for more than 30 minutes) (Klonoff et al., 1977; Klonoff et al., 1993) to 92% for those in coma more than two weeks (Heiskanen & Kaste, 1974) and 100% for a sample in coma for an average of four weeks (Richardson, 1963). Children with coma of more than three days duration show a dramatic decline in reading skills (Chadwick et al., 1981). Indicators of injury severity effectively predict reduction in classroom grades, teacher ratings of impaired classroom behavior, parent and teacher ratings of declining performance in school, teacher ratings of defective learning and work skills, and deficits in performance on various tests of academic skills; even children who were in coma for a few hours show broad declines in academic skills and behavior (Arroyos-Jurado et al., 2000; Fay et al., 1994). The children followed up in these studies continue to perform poorly in school years after the injury: Because the follow-up intervals range from two years to twenty-three years post onset, these studies indicate that children do not outgrow or adapt to their academic deficits. Thus the research indicates that coma of any length is associated with substantial problems in school, "even a coma lasting for a few days may lead to severe deterioration of intellectual capacity" (Heiskanen & Kaste, 1974) and "moderately and severely head-injured children do not demonstrate long-term recovery from their injuries" (Fay et al., 1994).

Problems with the long-term retention of newly learned information appear to be especially persistent, occurring in one quarter of the Klonoff et al. (1993) mild sample, almost half of the children in another study who experienced more than one day of coma, despite normal I.Q. scores (Levin & Eisenberg, 1979), and in all of the children in a further study with coma durations greater than seven days (Richardson, 1963). Weaknesses on measures of memory, along with other neuropsychological measures, predict delayed progress in school at a five year follow-up (Klonoff et al., 1977).

The more severe the brain injury, the more likely it is that the student will be pulled out of the mainstream classroom. Greenspan and MacKenzie (1994) found that 78% of their children with more severe injuries were enrolled in special education at one year post onset, compared to between 22 and 29 percent of the children in the moderate severity ranges. Janus et al. (1997) report that 75% of children with more than 24 hours of coma were in full-time special education programs at two years post onset, while in another sample with moderate and severe injuries seen two or more years post onset, 100% were receiving some special education, and 79% were receiving mainly or exclusively special education. Kinsella and associates (1997) found that 70% of the children with severe injuries were receiving special education at two years post onset, while 40% of those with moderate injuries were receiving these services. Brink et al. (1970) found 87% of their children returning to mainstream school settings after coma of one week or longer were in special education programs at 1 to 7 years post onset, and most were performing below expectation. These studies do not describe any children placed in special education who returned to full-time mainstream education.

With the weight of evidence indicating that "for the majority of brain-impaired children living in industrialized countries, the formal learning demands of school often prove to be quite difficult" (Rourke et al., 1983), some experts have concluded that it is necessary to place students in non-mainstream classrooms, or to reduce expectations for academic performance (Blosser & DePompei, 1994). But placing children in non-mainstream classrooms should be a last resort. Under the most recent applicable federal legislation, the Individuals with Disabilities Education Act or IDEA, placement at the least restrictive level, in mainstream classrooms if at all possible, is mandatory (Clark et al., 1999; Conderman & Nelson, 1999). This study finds that mainstream placement is feasible for most of the students after a course of intensive cognitive rehabilitation. Furthermore, this research indicates that the majority of these students do not pay for such placement with academic failure; rather they perform at or above their premorbid levels. Examining the conditions under which mainstream placement is effective, severity of impairment is found not to restrict students who are armed with appropriate compensatory techniques to deal with the sequelae of injury.

The Struggle of Parents and School Personnel to Conceptualize the Problem

Parents leave the hospital setting having witnessed a virtual miracle. Their child almost died in intensive care, then remained unresponsive for a period of time, and then emerged a mentally primitive and totally dependent individual. Over the ensuing days and weeks, the child gradually came alive, regaining the abilities to communicate and to care for his or her own needs, and beginning to walk. It is not difficult to understand that they often erroneously conceptualize this rapid improvement as the healing of the brain and develop unrealistic expectations of complete recovery (Telzrow, 1987). Unfortunately, hospital staff do not routinely disabuse them of this notion. Therapists often discuss improvement to the exclusion of any mention of permanent deficits, and physicians often provide incomplete or overly technical information. For the very small percentage of parents who are offered detailed family education workshops at a highly specialized head injury rehabilitation facility, most are shocked to discover that cognitive impairment is going to be a serious, permanent problem.

The typical parent and child return home from hospital anxious for school to resume. If extended convalescence is required, schools offer homebound instruction. Unfortunately the homebound instructor's simplified curriculum and testing approach, which is so effective in rapidly progressing medically ill students through missed material, does not require the head-injured child to use the missing skills and so extends the false sense of security.

At this point, many brain-injured children are returned to the mainstream educational system without any special assistance (Shurtleff et al., 1995). Once back in the classroom, the child's sympathetic teacher is likely to relax standards temporarily. After a few months of missed assignments and poor test scores, the teacher is beginning to realize that they do not represent a temporary adjustment problem. But the student has also fallen much further behind, and will be unlikely to catch up again during that academic year. Moreover, peers have now come to recognize the lasting changes in the survivor's behavior, and have begun to pull away. Behavior problems now may appear in the classroom. The student is usually the last one to realize the ex-

tent of the brain disorder, which adds still another emotional burden.

When parents and school officials recognize that something serious is wrong, a child study team is delegated to develop an Individualized Educational Plan. Now a new obstacle is encountered. Most schools are prepared to serve an impaired student through the system developed for developmental learning disability, mandated by public laws enacted in the 1970's. It is often very difficult for school officials to recognize that the head-injured child does not have a learning disability, cannot be served effectively by this system (Beers, Goldstein & Katz, 1994; Ylvisaker, Szekeres & Hartwick, 1994), and is entitled to disability-appropriate services by IDEA, most recently revised in 1997 (Blosser & Pearson, 1997).

In many school districts, a child is allowed into the special education system only by qualifying as learning disabled according to the provisions of the outdated public laws, based upon the findings of the school psychologist. However, this professional has no access to tests developed for assessment of head injury, and the school psychology tests are quite insensitive to head injury deficits (Cohen, 1986). The tests tap remote memory for information learned before the injury, which is not an area of deficit, and the examiner is directed to provide high levels of structure and motivation, while the child's inability to self-generate structure and motivation represents one of the primary deficits of the condition (Blosser & DePompei, 1994). Thus I.Q. and achievement testing are often normal in students who have serious cognitive impairments, and at best seriously underestimate the true severity of impairment (Janus et al., 1997; Nelson, 1992; Richardson, 1963). On the basis of the school psychologist's testing, the child study team may decide that the child is not learning disabled (which he or she is not) and therefore ineligible for special services (which is not true). Eventually, the child's learning deficit will pull achievement scores down to the qualifying level under the old law, but this is likely to require several years. This outcome is truly unfortunate, as it allows the student to experience protracted failure, lose self-esteem and possibly establish patterns of problem behavior which will complicate all aspects of academic and personal adjustment (Lazar & Mendalino, 1995).

For such children, a persistent parent familiar with the new public law and bearing appropriate medical documentation, perhaps even accompanied to the IEP meeting by the neuropsychologist, can usually obtain special services. But this victory can prove to be Pyrrhic. The educational professionals who work with brain-injured students may lack specific training with this disorder (Blosser & Pearson, 1997; Shurtleff et al., 1995) and tend to have widely varying and often inaccurate ideas about how brain injury affects long-term adjustment in school (Arroyos-Jurado et al., 2000; Farmer & Johnson-Gerard, 1997; Hux, Walker, & Sanger, 1996). To truly be of help, the academic professional (as well as the parent) needs specialized knowledge about the effects of head injury and methods of remediation of cognitive deficits (Fay et al., 1994), because addressing the cognitive deficits is a prerequisite to remediation of the student's academic performance (Cohen, 1986).

For those who want to learn about traumatic brain injury excellent texts are available as starting points, addressing the overall problem (Gronwall et al., 1998), theories of remediation (Prigatano, 1999), training techniques (Sohlberg & Mateer, 1989) and applications to children (Ylvisaker et al., 1995). Soliciting rehabilitation experts to provide workshops is also advisable (Blosser & Pearson, 1997). Ultimately, the effort will require the development of new teaching materials and approaches at school, as well as new procedures at home (Janus et al., 1997). Indeed, an optimal result will require the parents, school personnel, and rehabilitation staff to work together as a team (Blosser & Pearson, 1997).

Evaluating the Clinical Problem

The teacher, therapist or parent who wishes to understand the injury needs both generic information about head trauma and specific information about the child's own test results (Janus et al., 1997). Traumatic brain injuries place specific cognitive skills at special risk because of the high probability of damage to certain vulnerable brain structures. Head trauma frequently impales the brain on the bony prominences on the inside of the skull, producing zones of permanent damage in the frontal and temporal lobes (Jennett & Teasdale, 1981). Moreover, trauma involving strong forces, for example, in motor vehicle collisions, destroys many individual brain cells throughout the brain by tearing them apart, especially in areas such as the hippocampi (Graham et al., 1987). Damage in these areas produces the cognitive impairments most characteristic of traumatic brain injury, in new learning, planning and organization, controlling impulses, pacing the speed of responses, and noticing errors (Janus et al., 1997; Lezak, 1983; Levin, 1987). Other areas of focal damage may result in additional changes in other brain systems.

The effects of traumatic brain injury on a specific student can be gauged by reviewing three kinds of information. Concentrated or "focal" damage is revealed by areas of abnormality on CT and MRI scans interpreted as showing contusions (bruises), intraparenchymal/intracerebral/ petechial hemorrhage (bleeding within the brain), encephalomalcia (the abnormal density of damaged brain tissue), infarction (damage from loss of blood) or edema (swelling). Subdural and subarachnoid hematomas (blood pooling above the surface of the brain) may also produce focal damage, especially if they are large enough to produce midline shift, mass effect or ventriclar compression (changing the shape of the brain). Any scan which shows these abnormalities indicates permanent brain damage; later normal findings, particularly on CT scans, do not mean that the brain has healed.

Diffuse damage is revealed by the clinical finding of anoxia (loss of oxygen to the brain) and by the length of the coma and of post-traumatic amnesia (the memory gap surrounding the trauma). In many research studies, a patient who is fully comatose upon admission to the hospital is regarded as severely injured and expected to show some amount of long-term disability (Krauss et al., 1987). It has been suggested that post-traumatic amnesia of one day represents the boundary of severe brain injury (Lezak, 1995). The children who are treated in hospital-based cognitive rehabilitation programs, such as those in the present study, have much more serious injuries, with coma and post-traumatic amnesia durations measured in days or weeks.

The definitive measure of the extent and nature of brain impairment in traumatic brain injury is neuropsychological testing (Kolb & Whishaw, 1990). While many test measures are available, some measures are in relatively common usage by head injury specialists. Tests from the Halstead-Reitan Neuropsychological Battery appear to provide useful information (Farmer, Clippard & Luehr-Wiemann, 1996), concentrating on the sensory, motor and problem-solving skills. Most

neuropsychologists augment the battery with measures of new learning and recall, such as the Wechsler Memory Scale, and measures of the executive skills (for example, one of several word fluency measures or a modification of the Mazes subtest of the Wechsler Intelligence Scale for Children, as recommended by Lezak, 1983). Multiple-choice format testing imposes a special problem for students with executive impairments, and for this reason reading comprehension is evaluated most conservatively by a procedure such as the Gates-MacGinitie (MacGinitie & MacGinitie, 1989) reading test. Kaplan (1989) has refined an interpretive method which is highly useful in translating test performance into rehabilitation-relevant inferences about brain processes.

The neuropsychological evaluation report is a detailed document which reviews the medical facts of the injury, relevant history, and test findings. Recommendations for school placement and accommodations for impairment are usually included in these analyses. However, it cannot be presumed that the evaluation includes a process analysis or a comprehensive account of compensation strategies, as experience with comprehensive cognitive rehabilitation programs is not a routine component of neuropsychological training or experience.

Compensation for Traumatic Brain Injury's Primary Deficits

Thirty-five years ago, specialty programs for rehabilitation of brain injury did not exist. In recognizing the very poor outcomes of severe head injury in conventional medical and educational systems, a first generation of rehabilitation specialists established head injury centers based upon principles of behavior modification. These programs demonstrated that head injury survivors could be trained to improve performance, but the extent of the improvements and the degree to which they improved actual real-world functioning were disappointing.

Cognitive rehabilitation evolved as an aggressive attempt to restore the damaged cognitive skills of brain injury patients, in the hope that targeting brain functions directly would restore function more fully. The procedures described in this article had their origins in the innovative program for stroke rehabilitation developed by Leonard Diller at New York University, applied to traumatic brain injury and extended to new areas of cognition by Yigal Gross, Yehuda Ben-Yishay and their colleagues in Israel, and later at Robert Wood Johnson Rehabilitation Institute in New Jersey and at NYU. At these facilities, and at other programs they inspired, cognitive rehabilitation was an intensive and carefully orchestrated undertaking of many months, with therapy teams working to remediate brain processes in many different areas of content. Thirty years of experience with this enterprise have led to several conclusions about cognitive recovery, summarized by a set of principles listed here:

1. Impairments are permanent. Efforts to correct basic skill deficits have been largely disappointing. Skill training exercises have proven useful in making patients more focused, faster and better paced in their responses, but they have been relatively ineffective in correcting higher-level deficits in areas such as memory and executive skills (Ben-Yishay & Prigatano, 1990; Gross & Schutz, 1986).

2. If the impairment cannot be removed, it must be addressed with compensation strategies. These strategies are deliberate procedures used by the survivor to avoid relying upon an impaired skill, to substitute a stronger skill, or to bring into play corrective habits or assistive resources. For example, if you forget to bring your jacket home from school again and again, put it in your backpack whenever you take it off, or ask your teacher to alert you if you leave it behind.

3. Fully effective compensation strategies are readily available. The best strategies depend upon understanding each problem neuropsychologically and from a specific perspective that focuses not on what the body is doing wrong (ineffective behavior) but what the brain is doing wrong (ineffective cognitive process) (Cohen, 1986). There are generic strategies appropriate for the cognitive sequelae of traumatic brain injury, which are discussed below, and they can be individualized and fine-tuned in the rehab clinic or professional office, and practiced there until the person is using each one properly.

4. A compensation strategy only works if it is administered effectively in the real world. When cognitive rehabilitation fails, it is usually for one of two reasons: Either the patient rejects the need for the strategy because of a failure to understand and accept what the injury has done (Prigatano, 1999), or the patient corrects the deficit in the clinic but fails to generalize the strategy to the real world settings where it is needed (Janus et al., 1997; Meichenbaum, 1985; Schutz & Langenbahn, 1985; Ylvisaker, Szekeres, Hartwick, & Tworek., 1994; Ylvisaker & Szekeres, 1998). Even the most fully developed cognitive rehabilitation programs have a substantial minority of patients who do not use their training after discharge and remain subfunctional in their major life roles. Those who fail tend to be immature or psychologically maladjusted (Ben-Yishay et al., 1980; Prigatano et al., 1984; Schutz, Barry, Gross, & Tupper 1984), although there are instances in which a person became ready to accept the need for the compensation some time after treatment had ended (Lewis & Schutz, 1984). Rehabilitation outcomes for adults demonstrate a striking relationship with the level of motivation for coping activities in the basic personality: The more strongly the coping orientation, the more likely that the person will be independent in daily living and successful in going back to work (Schutz & Micucci, 1984). Those who place coping at a low priority tend to neglect the use of their compensation strategies after leaving the clinic.

5. When the patient is not disposed or able to manage his own generalization, sometimes it can be managed by others with good results. For example, family members can play the role of taskmaster, which can improve the ultimate treatment outcome (Schutz & Lewis, 1985). Although children have proven able to generalize cognitive compensation strategies (Suzman et al., 1997), they are likely to need more support than adults, through the participation of the parent, the classroom teachers and the special education teacher (Ylvisaker et al., 1995).

The head injured students who are subjects in the present study received treatments designed by the first four principles above. The fifth principle has received greater emphasis over the course of the study. The compensation strategies in which these children and young adults were trained are listed below:

1. Response pacing: The head-injury patient is unable to perform tasks as quickly as before the injury without making errors. Training activities of various kinds first seek to restore

accuracy (similar to Meichenbaum, 1977), and then experiment with increasing speed of performance.

2. Response optimization: People intuitively adjust the way in which they use skill routines to match the level of task demand. If the level of skill required for success or the cost of failure is very high, the routine will be used with extra caution, preparation and effort. Contrast carrying a stapler with carrying an egg, carrying a Faberge egg, and carrying a bottle of nitroglycerine, or contrast playing horseshoes against one's mother, one's new girlfriend, one's coach, or a neighbor who has wagered a thousand dollars on the outcome. These situations call for different levels of response optimization. Intuitive approaches to response optimization are completely ineffective after a head injury. The subroutine must be carefully adjusted so that more optimization is used for every activity, but especially for those involving skills which are more impaired. Optimization must also be used selectively to correct for the ways in which fatigue and emotionality interfere with skills of all kinds. Here is an algorithm for response optimization: (a) Recognize that I am about to do something that is hard for me, or in which I could make a mistake (Ylvisaker et al., 1995); (b) Stop and think (Meichenbaum, 1977); (c.) Review my goals and the steps of my plan (Premack, 1970; Ross, 1967); (d) Focus, avoid getting distracted (Sohlberg & Mateer, 1989); (e) Control emotion, not only negative feelings (Meichenbaum, 1985) but any excessive arousal; (f) Start only when ready; (g) Proceed as slowly and carefully as needed in order to be sure to be totally accurate; (h) Make sure I am doing what I planned (Miller, Galanter & Pribram, 1960); (i) Do it again with a better plan if the results are not good enough (Gross & Schutz, 1986). This routine needs to be practiced in many different settings, and toward many different goals, in order to adequately generalize (Schutz & Langenbahn, 1985) the resetting of the subroutine. In the present study, one of the training activities used to address this area provides a criterion measure for the adequacy of participation in the program.

3. Time management and activity planning: Each student is directed to use a scheduling system in which every day is planned completely in advance, under the guidance of a family member. The schedule is then used to prompt recall of the planned activities. Detailed scheduling self-generates some of the structure which is known to improve cognitive functioning for brain-injured people in general (Cruikshank, 1967), and is essential to assure that students know about their assignments and organize their time commitments (Janus et al., 1997). Sohlberg and Mateer (1989) recommend a similar scheduling procedure for cognitively impaired adults. Graduates are advised that continuing with this scheduling system after rehab is essential to success in school.

4. Verbal learning: A system of note-taking, data reduction (by highlighting and outlining) and self-testing (on flash cards) for both readings and lecture material represents the core strategy, based upon procedures developed by the senior author for inner-city college students with deficient study skills. The necessity for using note taking and other recording procedures as the foundation of verbal learning is well demonstrated (e.g. Mateer, Kerns & Eso, 1996). Training establishes success in using these techniques to respond to short-answer questions for progressively longer material, and ultimately for essay questions. Self-testing offers powerful advantages in aiding memorization, by providing operant rewards as well as by associating material with its anticipated context of usage, and by progressively eliminating material which has been mastered, thus reducing the study load with continuing effort. Training takes place across two to three hours per week, with intensive homework requirements for each in-session hour. Duration of therapy is typically two to four months. In the present study, criterion variables assess final goal attainment for the verbal and auditory modalities.

5. Problem solving: a formal, written algorithm for anticipating and planning responses to practical and social situations was developed by the senior author at Robert Wood Johnson Rehabilitation Institute for use with patients of higher intellectual endowment. A second algorithm is a retrospective analytical tool used to analyze how previously-used plans failed in real-world situations, to replan the unsuccessful effort, and to generalize the plan to anticipated future opportunities. These algorithms implement highly structured forms of procedures advocated by Meichenbaum (1977, 1985). This training component includes intensive education about the nature of the individual's cognitive impairments and their functional consequences (e.g., Cohen, 1986) necessary to comprehensive planning. Family members may be included in this training process.

6. Additional therapies focus on specific deficit areas on an individualized basis. These may include safety judgment, visual perception, social perception/inference, social interaction, organization of expressive language, and traditional rehabilitation therapies.

The subjects in the present study received intensive rehabilitation for a period ranging from two to six months. They were discharged without having met their rehabilitation goals only if they withdrew from treatment, refused to cooperate with treatment procedures and program regulations, or failed to make reasonable progress on a month-by-month basis. No patient was discharged for financial reasons. Hence all had the opportunity to meet their goals given an adequate effort to participate and cooperate.

Method

Subjects: Fifty-one students (27 males and 24 females) with a diagnosis of traumatic brain injury included 37 in high school, 12 in college and two graduate students. The mean age was 17.9 years (SD = 2.6).

This group can be characterized as severely impaired. Of the 51 subjects, 47 demonstrated one or more focal lesions on CT or MRI scans. All subjects were either focally damaged or in a coma for more than 24 hours, with most showing both. All but two (96%) of these subjects would be classified as severe by the Glasgow Coma Scale criteria utilized in the research literature reviewed above. The mean duration of coma was 9.4 days (SD = 9.9), with the longest being 47 days. Mean duration of anterograde amnesia (from time of onset to first new memory) was 29.0 days (SD = 24.0), while mean duration of retrograde amnesia (from last pre-onset memory to time of accident) was 58.1 hours (SD = 130.3).

Procedure

Subjects were evaluated upon discharge from inpatient rehabilitation or medical hospitalization. Neuropsychological and

speech-language test batteries were administered as a part of the program intake battery, and there was an intake interview in which family members participated (and in which family socioeconomic data and academic history data were obtained). A modified Halstead-Reitan Neuropsychological Test Battery, augmented by tests from the Woodcock-Johnson Psychoeducational Test Battery, the Wide-Range Achievement Test, and the Gates-MacGinitie Reading Comprehension Test were employed. This testing was conducted at a mean latency of 2.0 months post onset (SD = 1.1).

Rehabilitation progress was evaluated against objective performance criteria on a monthly basis. Family cooperation with recommendations for participation was evaluated in these team meetings. Progress toward meeting the objective criteria in each treatment area was reviewed, including the three goals (impulse control, verbal learning from an auditory medium, and verbal learning from a written medium) evaluated as met or unmet at discharge for purposes of the present study.

Follow-up data were obtained in one of three ways. First, 39 students were seen for routine or incidental follow-up examinations. Second, 8 students were seen because of referrals for re-evaluation. For the first two groups, the mean follow-up interval was 13.4 months (SD = 10.1) Third, four students were classified as negative outcomes at the completion of rehabilitation because of their post-discharge placement.

Results

Twenty-seven of the fifty-one students (54%) were classified as fully favorable educational outcomes, which meant that the student was receiving a mainstream program, had not been held back, and had achieved a grade-point average comparable to (no lower than 0.5 grade points below) or better than the average prior to injury. Eighteen students (35%) had improved their grades, four were getting the same grades, and five had declined slightly. Twelve were classified as negative outcomes because of substantially lower grades. Eight were placed in special education programs. Two had elected to return to school but not at their former level (a graduate student taking only undergraduate courses, and a high school student who transferred to a vocational campus). Two had dropped out of high school.

Standard discriminant function analyses were performed to determine the characteristics of this outcome. The first discriminant function utilized treatment criteria achieved during rehab, family participation in treatment, family socioeconomic status, honors student status premorbidly and learning disability status premorbidly. This function proved to be highly significant ($F = 12.47$, $p < .0001$) and achieved a 90% accurate classification of students, with one false negatives and four false positives. Examining the components of the function, most of the classification accuracy was achieved by the treatment criteria acieved variable ($p = < .0001$). This variable is correlated with the outcome measure at $r = .76$ ($p < .001$), and with grade point average at follow-up at $r = .73$ ($p < .001$). Premorbid honors status is correlated with the outcome measure at $r = .41$ ($p < .01$), and the two family variables (socioeconomic status and adequate participation in rehab) are at $r = .41$ ($p < .01$) and .39 ($p < .01$). Premorbid learning disability is not significantly correlated with the outcome measure.

A second discriminant function analysis examined measures of severity of impairment (coma, retrograde and anterograde amnesia, and chronicity of the injury at evaluation) and lateralization of lesions as predictors of educational outcome. This function was nonsignificant ($F = 1.74$, $p > .05$), as were correlations between the component measures and the outcome measure.

A third discriminant function employed a number of ability tests, including WRAT Arithmetic, Gates Reading Comprehension, Wechsler Memory Scale Revised Digit Span forward and backward, Woodcock-Johnson Antonyms-Synonyms and Analogies, high-sensitivity measures from the Halstead-Reitan Battery (Trail Making Part B and the Category Test), measures targeting verbal learning and recall (Wechsler Memory Scale Logical Memory delayed recall, Rey Auditory Verbal Learning Test delayed recall) and measures targeting executive skills (Controlled Oral Word Association and Mazes) as potential predictors of educational outcome. Again, this function did not reach significance ($F = 1.09$, $p > .05$).

The final discriminant function utilized data concerning the localization of focal lesions to predict educational outcome. This function was nonsignificant ($F = 1.26$, $p > .05$).

Discussion

A group of head-injured students learned compensatory techniques for post-traumatic cognitive deficits, addressing deficiencies in verbal learning and executive function, most meeting the program's discharge criteria within a few months. When the training was successful, the student was highly likely to return to mainstream education and most performed comparably to or better than before the injury. Achieving success in the training process is the best predictor of success upon return to school, accounting for more than half of the variance in the educational outcome. This result suggests that the strategies and experiences produced by this treatment regimen are sufficient to offset the cognitive consequences of very severe head injury for a majority of patients.

These techniques are shown to be applicable across a broad range of severity of injury and impairment: The measures of neurologic severity and neuropsychological impairment are not significantly related to the educational outcomes of program graduates. This finding is remarkable, in that such measures are significant predictors of educational outcome for students who do not receive cognitive rehabilitation, according to previous research. Apparently the rehabilitation served as a "great equalizer," allowing patients with more severe injuries and deficits to achieve good educational outcomes.

The patients who achieved poor outcomes were poor participants in the treatment process. In no case was there evidence that the patient was unable to complete the work. Failure occurred as a consequence of a lack of effort and follow-through. Many of the unsuccessful patients were chronic underachievers. Many also had no family support for their rehabilitation and academic re-entry.

The reverse is equally true: Students who were high achievers before their injuries and/or came from successful families tended to do better in rehab and after rehab. This result corresponds to the outcome findings for adults: Motivation to cope and to achieve clearly facilitates recovery through rehab. The student who is highly motivated and mature, presented with the opportunity to learn an effective game plan for recovery, is unlikely to need additional help to achieve a good outcome. Where the student lacks these qualities, it is important to reach out to the family to forge an alliance to support the therapy, and/or to the school so that further efforts can be made to promote recovery when rehab has not been fully successful.

The findings suggest that the verbal learning and basic ex-

ecutive skills deficits are indeed at the core of the educational impact of traumatic brain injuries. When these deficits can be corrected through compensatory information intake and studying methods, scheduling to organize time, and response optimization procedures, students can be effective even at the highest educational levels. These techniques are shown to be effective as long as they are employed, i.e., as long as the student participates adequately in the rehab process. The techniques can be expected to fail only when there has been a half-hearted effort on the part of the student, the family, and perhaps also the professionals.

It should be noted that a few of these students initially took a reduced course load upon returning to school. This is not a negative outcome, but rather a necessary accommodation (Janus et al., 1997; Shurtleff et al., 1995). Preparation and learning require dramatic time commitments, and for this reason a full course load was unrealistic. A few students still restrict their course loads. Beyond this concession to practicality, and the removal of time limits for testing, this rehabilitation effort has been committed to the goal of preparing the student to meet mainstream standards, rather than asking the schools to lower their standards to adapt to the student. The present results are held to show that this goal is attainable, and therefore worthwhile.

In view of the negative outcomes clearly shown to occur without cognitive rehab, it seems remarkable that so many of the rehab students are able to perform in school at such a high level after only a few months of treatment. Seventy-six percent returned to school in mainstream programs. Within the successful group, more than 85% were earning a straight B average (3.0) or better. Five were earning perfect grades. One has straight A's through the last two years of high school and her first year of college. Ten of the twelve members of the successful group who were followed past high school graduation are now in college, and all are succeeding at this higher echelon. Four of the college students have now earned Bachelor's degrees, and one went on to earn her Master's degree, obtained and retained a professional position, and is now pursuing another graduate degree part-time. These students with very severe injuries certainly do not appear educationally disabled in any meaningful way, except that each one has related that school is more difficult and still requires much more preparation than before the injury.

Perhaps it is just as remarkable that more than one-third have actually improved their academic performance despite the severe brain injury. Many of these students credit not only the compensation strategies, which they describe as a better way to study and self-organize, but an improved attitude toward the importance of scholastic success, and a stronger sense of personal accountability. Clinical experience suggests that both a proper attitude and appropriate compensation strategies are necessary for a good outcome, and that neither alone is sufficient.

The public policy implications of this research appear to be profound. The effectiveness of these techniques is sufficient to merit consideration of universal access for all students with head injuries at levels of severity comparable to the research sample. In this light, future research should track these recoveries over a longer time interval, with a matched control group of students who did not receive rehabilitation, and a second control group of students who received traditional therapies. Such a study would clarify the contribution of the specific rehabilitative techniques and allow a cost-benefit analysis.

The initial goals of the cognitive rehabilitation movement were to discover and demonstrate a procedure that would prevent the inevitable impairments of traumatic brain injury from becoming permanent disabilities. This goal appears to have been met for a subgroup of head-injured students with very severe injuries. Upon this success follows the challenge to make this advance more widely available to the children who need it.

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Phonological Development in African-American Children Prenatally Exposed to Cocaine

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ABSTRACT: *This study investigated the phonological development for 18 African American (AA) 2-year-olds from African American English (AAE) speaking homes. Ten toddlers had been prenatally exposed to cocaine and eight were unexposed. It was hypothesized that, when compared with a matched group of children who had not been exposed to drugs, the exposed group would differ in phonological development. Clinicians phonetically transcribed 100 words from spontaneous language samples collected within a variety of play contexts. Phonological data were entered into the Interactive System for Phonological Analysis (Masterson & Pagan, 1993) for detailed analyses of phonemic inventory, phonological processes, and word shapes. Data were also examined for evidence of phonological patterns typical of AAE. Two-tailed t tests for independent means indicated no significant differences between groups for any of the variables examined. Results from a power analysis of phonological process data revealed that the lack of significant group differences may be due to lack of power. Although both groups displayed phonological patterns possibly attributed to dialect influences, no clear distinction between dialect and normal developmental patterns could be made. Despite findings of no statistically significant differences between groups. AA toddlers prenatally drug exposed (PED) may still be at risk for later phonological awareness, reading, and academic difficulties. Dialect influences are also more likely to become evident with age. Clinicians should continue to monitor the phonological development of AA toddlers PED until their school age years, while taking the possibility of dialect differences into consideration when assessing the later phonological development of AA children PED.*

KEY WORDS: *prenatal cocaine exposure, phonological acquisition, African-American English*

Introduction

Over the years, there has been increased attention to health issues affecting the lives of minority children, particularly those living in urban communities. This increased attention to minority child populations is related to the fact that minority children and families living in inner city communities have been found to be at greater risk for certain medical, health and developmental conditions due to poverty, poor living conditions, limited access to quality healthcare, and a number of other environmental concerns (Terrell, 1993; Groce & Zola, 1993; Wallace, 1998).

One of the health issues that has received the greatest attention is that of prenatal exposure to drugs. According to recent statistics, approximately 5 to 15% of infants born in urban settings of the United States are born prenatally exposed to drugs (PED) (Harvey & Kosofsky, 1998; Neuspiel, Hamel, Hochberg, Greene, & Campbell, 1991; Singer et al., 1997). African American (AA) children form a significant percentage of children living

in urban settings where drug use is prevalent (Ensminger, Anthony & McCord, 1997). According to Wallace (1998), the drug problem in many inner-city communities can be attributed to issues of "despair," poverty and "the easy accessibility of drugs" (p. 314).

Although maternal substance abuse is an issue that affects women from all backgrounds and communities, much of the research to date has focused primarily on minority women (Bland, 1996; Harvey & Kosofsky, 1998; Neuspiel, et al; 1991). However, Chasnoff, Landress & Barrett (1990) suggest that the greater focus on minority maternal drug users may be a function of differential reporting and screening procedures. In a study of pregnant women entering private clinics, Chasnoff et al. (1990) found that the proportion of black maternal drug users reported to public health authorities was "10 times higher" than other maternal drug user groups, even though the rates of substance abuse in black and white women was similar.

Despite apparent disparities in the reported incidence of maternal drug use among AA women, speech-language pathologists and educators working in urban school settings serving AA child populations need to be mindful of how prenatal drug exposure can put these and other children at risk for delays in a number of developmental areas, including language and academics (Begley, 1997; Rivers & Hedrick, 1992). Regarding their language development, semantic delays have been observed in children PED (Bland-Stewart, Beeghley, Seymour, & Frank, 1998), syntactic (Rivers & Hedrick, 1992, 1998; van Baar & de Graff, 1994), as well as pragmatic development (Mentis & Lundren, 1995). They have also been described to be at risk for different phonological disorders and delays (Madison, Johnson, Seikel, Arnold, and Schulthesis, 1998).

Speech-language pathologists (SLPs) who work with AA children with a history of PED must be able to accurately identify and serve those children who are at risk for phonological difficulties. This includes children who are speakers of African American English (AAE). For this group of children, the identification of phonological delays may present challenges for SLPs because some phonological patterns produced by preschool- and school-aged Standard American English (SAE) speakers, with language disorders speakers represent normal phonological usage of AAE dialect child speakers.

To establish a clinical and research framework for examining the phonological skills of AA toddlers PED who are becoming AAE speakers, the normal phonological development of AAE child speakers will be discussed. Furthermore, the phonological development and skills of AAE child speakers PED will be described.

Phonological Development of AA Children

Children with typically developing speech. Researchers have noted a strong compatibility between the developing phonological rule systems of younger and older AAE speakers. Seymour and Seymour (1981) and Haynes & Moran (1989) found phonological processes produced by younger AAE child speakers that appeared to be precursors to the acquisition of AAE phonological features. They include substitution of voiced and voiceless "th" sounds (Seymour & Seymour, 1981) and final consonant deletion (with voiced sounds being the most susceptible to deletion). These phonological processes typically disappear in the linguistic systems of SAE child speakers at approximately four years of age.

Researchers have found evidence that AAE child speakers, acquire and produce the variable rules commonly seen among AAE adult speakers as early as three years of age (Stockman, 1993; Stockman, Vaughn-Cook, & Wolfram, 1982). For example, Stockman et al. (1982) found that similar to older adult speakers, 36- and 54-month AA children residing in the Washington, DC area displayed final nasal consonant omission patterns where: (a) final /n/ was absent more often than /m/ and (b) both consonants were less likely to be omitted when the next word or syllable began with a vowel (vs. a consonant) or when no word followed.

Researchers have noted that the phonological development of AAE child speakers younger than three years is similar to that of SAE child speakers (Stockman & Settle, 1991). In an unpublished study on the phonological development of young AA children, Stockman and Settle observed that up until three years of age, typically developing AA children use the same minimal core of initial consonants ([m, n, p, k, g, h, j, t, d, and s]) as their white SAE speaking peers. Seymour and Seymour (1981) and Haynes and Moran (1989) also found that even though preschool-aged and young elementary school-aged AAE child speakers display speech sound patterns that distinguish them from their SAE speaking peers, they also displayed patterns that were similar.

Collectively, findings from these and other studies suggest that although the early phonological development of AAE child speakers may resemble that of other children, there is a point in development where their speech sound development may diverge from that of SAE speaking children. This divergence does not constitute deviant phonological development, but rather a "systematic application of phonological naturalness and marking principles that guide phonological variation and change toward a more natural state in different types of language situations" (Wolfram, 1994, p. 238).

Children with phonological disorders. In addition to comparing the phonological development of typically developing AAE and SAE speakers, several studies have also examined how the phonological development of AAE child speakers with disorders differs from that of typically developing peers from similar dialect backgrounds. When comparing six AAE child speakers who were normally developing and seven AAE speakers who were receiving speech therapy services, Seymour, Green, and Huntley (1991) found more frequent use of liquid simplification by the group receiving speech services. Similarly, when Bleile and Wallach (1992) analyzed the speech production patterns of AA children with normal language development to children with language difficulties, they found little difference between the groups in their production of final sounds typically associated with AAE (e.g., final nasals, clusters, etc.). However, the children who had difficulties with language development, displayed a greater number of initial and medial sound errors when compared to their counterparts. The children who had noted language difficulties also displayed more errors involving nasals, the /r/ sound, initial consonant clusters as well as significantly more errors involving more than one or two stop consonant or fricative sounds.

The Speech and Language Development of Drug-Exposed Children

Language Development. As previously stated, a number of studies involving infants and toddlers PED have shown delays in all aspects of language development, including semantics, pragmatics, and syntax (Bland, 1996; Bland-Stewart et al. 1998;

Johnson, Foose, Gettles, Seikel, & Madison, 1997; Malakoff, Mayes, & Schottenfeld, 1994; Malakoff, Mayes, Schottenfeld, & Howell, 1999; Mentis & Lundren, 1995; Rivers & Hedrick, 1992,1998; van Baar & de Graff, 1994). However, other studies, including Hurt, Malmud, Betancourt, Brodsky, and Gianetta (1997), found no significant deficits in the language development of children PED.

Phonological Development. Researchers have investigated the relationship between PED and phonological disorders. Some of them have found delayed and atypical phonological development in children PED when these children's phonological patterns were compared to normative data obtained from children who had not been PED (Bullock, 1994; Mentis, Bankson, & Plumondon, 1994). For example, researchers have shown that by two years a number of sounds emerge and begin to stabilize in the speech of typically developing SAE child speakers (e.g. /p/, /b/, /m/, /h/, /n/, /w/, /t/, /d/, /k/, /g/, /n/,/ŋ/) (Ferguson, Menn, & Stoel-Gammon, 1992; Sander, 1972; Stoel-Gammon, 1985).

The literature on typically developing toddlers reveals that many of the phonological processes common in young children's speech (e.g., final consonant deletion, unstressed syllable deletion, reduplication, consonant harmony, stopping, fronting, gliding and context-sensitive voicing, vocalization, and velar assimilation) begin to disappear between three and four years (Ferguson et al., 1992; Grunwell, 1987; Locke, 1983; Stoel-Gammon, 1985; Yavas, 1998). Research with toddlers PED suggests that compared to typically developing toddlers, toddlers PED are likely to exhibit: (a) decreased speech intelligibility (Bullock, 1994; Mentis et al., 1994), (b) restricted phonemic inventories (Bullock, 1994), (c) more simplistic or differing word shape patterns (Bullock, 1994; Mentis et al., 1994), (d) more frequently occurring and immature phonological processes (Madison et al., 1998; Mentis et al., 1994), and (e) more general articulation difficulties (Carrico, Rutherford, Zecker, & MacGregor, 1993)

There are a number of methodological issues that must be taken into consideration when interpreting findings from previous research on language development of children PED. They are: (1) the lack of control for confounding factors typically associated with prenatal cocaine exposure (e.g., pre-term birth, low birth-weight, dysfunctional caregiving, and prenatal exposure to other toxic substances, such as alcohol); (2) in some studies it is difficult to separate the unique effects of intra-uterine cocaine exposure from the effects of other drugs such as methamphetamine (Bullock, 1994); (3) in some studies the children examined were already receiving clinical services (Malakoff et al., 1994; Rivers & Hedrick, 1992), which is problematic since those children are likely to have greater speech and language problems at the time of intervention; (4) in some studies, the sample sizes used were too small, making it difficult to generalize their findings to other children PED (Bland-Stewart et al., 1998; Bullock, 1994; Mentis & Lundgren, 1995); (5) only three known studies have focused exclusively on the speech or language development of AA toddlers (Bland, 1996; Bullock, 1994; Mentis & Lundgren, 1995); and (6) no known studies with AA children have examined the influence of AAE dialect patterns on the emerging phonological skills of AA children who have and have not been PED.

The purpose of this study was to examine the early phonological skills of a group of toddlers prenatally exposed to cocaine (PEC) and a group of toddlers who had not been prenatally exposed to cocaine. Both groups were living in households where AAE was frequently spoken by the caregiver. The research questions addressed were: (1) Do AA toddlers PEC reared in AAE dialect speaking households differ in their phonetic inventories, frequency of phonological processes, and word shapes when compared to AA toddlers who had not been PEC living in AAE dialect speaking households? (2) What differences exist in the phonological skills of AA toddler who had and had not been PEC living in AAE dialect speaking households?

Method

Participants: The 18 toddlers participating in this study were between the ages of 2:0 and 2:11 years (mean age = 2:1) and were randomly selected from a pool of children participating in a larger, five-year longitudinal project funded by the National Institute of Health. The larger project was conducted to evaluate the potential multi-dimensional effects of in-utero cocaine exposure and associated risk factors on infant health, growth and development, neurodevelopmental functioning, and socioaffective development during the first two years of life (Frank et al., 1990).

In the larger study, 300 mother-infant dyads were recruited from the maternity ward of Boston Medical Center and followed over a two-year time span. Half of the recruited dyads included children who had been PEC while the other half included children who had not been PEC. Their biological mothers were at least 18 years old when they gave birth. Each caregiver signed an informed consent form prior to their child's and their participation in the study. They were from urban, low-income communities in Boston, Massachusetts.

The PED status of toddlers participating in the larger study was documented by maternal and/or infant urine or meconium assays at the time of delivery. The mothers of toddlers in the PED group also tested positive for cocaine metabolites at the time of delivery. The method of cocaine intake for the substance-abusing mothers was reported as inhalation (e.g., snorted and/or smoked). In addition to meeting the previous criteria, all children were born at 36 weeks or more gestation, had no obvious congenital malformations, had no early signs of fetal alcohol syndrome and had not required any mechanical ventilation at birth. Moreover, other than cocaine, they tested negative for HIV and for other drugs including, opiates, amphetamines, barbiturates, benzodiazepines, and hallucinogens. They were judged by the clinician to be physically healthy and free of any sensory or motor deficits.

An analysis of data collected from the larger project revealed no significant group differences with respect to prenatal marijuana exposure, prenatal tobacco exposure, average z-scores for infant birth weight, average z-scores for infant birth height, and average z-scores for infant head circumference. In addition, the two groups did not differ in the quality of the proximal caregiving environment, as assessed by the Home Observation For Measurement of the Environment (HOME; Caldwell & Bradley, 1984).

For the present study, there were ten children in the PEC group (7 boys and 3 girls) and eight children in the non-PEC group. Subjects in both groups were matched within and across groups on the following variables: age, gender, mother's educational level, and maternal age at delivery (See Table 1). The mean age of the children in the PEC group and non- PEC group were 2.0 years and 2.1 years respectively.

As a part of the larger study, the cognitive and language abilities of all subjects were assessed at 24 months, with the exception of one child who was assessed at 35 months, using the

Table 1. Participant demographic characteristics

	Non-exposed (n=8)		Exposed (n=10)		Total	
	No.	%	No.	%	No.	%
Gender						
Male	3	37.5	7	70	10	56
Female	5	62.5	3	30	8	44
Child living with*						
Both Biological Parents	0	0	0	0	0	0
Mother	8	100	8	80	16	89
Father	0	0	0	0	0	0
Foster Mother	0	0	1	10	1	5.5
Grandmother	0	0	1	10	1	5.5
Language spoken in home**						
Standard English only	0	0	0	0	0	0
Standard English/African American English	8	100	10	100	18	100
African American English only	0	0	0	0	0	0
Mother's background*						
Mean age (years)	24		24		24	
Education						
Less than 8 years	1	12.5	0	0	1	5.5
Some high school	2	25	7	70	9	50
High school graduate	4	50	2	20	6	33
Some college	1	12.5	1	10	2	11
College graduate or more	0	0	0	0	0	0
Mother's first birth	5	62.5	3	30	8	89

* Reported by guardian(s).

** Determined by examiner observation.

Sequenced Inventory of Communication Development-Revised (SICD-R; Hedrick, Prather, & Tobin, 1984) and the Bayley Scales of Infant Development, (BSID; Bayley, 1969). Although currently available standardized tests and developmental inventories developed have sometimes been found to yield biased results when used with AA children who are AAE dialect speakers, the language and cognitive skills of both subject groups as measured by the SICD-R and BSID were found to be within normal limits. Analyses of the groups' performance on the SICD-R and the BSID revealed no significant differences between them on two measures. Descriptive statistics regarding the children's performance on the SICD-R and BSID can be seen in Table 2.

Mean length of utterance (MLU) measures were also calculated for all subjects. According to Seymour, Bland-Stewart, & Green (1998), MLU can serve as an inappropriate language measure for young AAE speakers and should not be used to establish language levels. As a result, MLU was used in the current study as a descriptive index of utterance length for subject-group comparison purposes only. Results from the MLU analysis revealed similar findings for both groups with children PEC

Table 2. Group performance on standardized assessments of language and cognition (SICD-R, MLU, and BSID) for eight toddlers without prenatal cocaine exposure and ten toddlers with prenatal cocaine exposure

	Non-exposed (n=8)			Exposed (n=10)			
Standardized Measures	M	SD	Range	M	SD	Range	
SICD-R							
	ECA (months)*		26.0	6.0	16-32	22.0	4.2
16-28							
	RCA (months)*		24.0	1.1	24-28	24.0	1.9
24-28							
MLU*	1.9	0.5	1.3-2.45	1.8	0.3	1.4-2.4	
BSID							
	MDI*	107.0	9.0	88-100	95.0	10.8	83-114
	PDI*	106.0	11.4	87-118	99.0	11.5	77-118

*$p > .05$ = No statistical difference found between groups when compared on this measure.

Note: Groups did not differ significantly on these variables:

SICD-R: Sequenced Inventory of Communication Development-Revised

ECA: Expressive Communication Age (in months)

RCA: Receptive Communication Age (in months)

MLU: Mean Length of Utterance

BSID: Bayley Scales of Infant Development

MDI: Mental Development Index (population M = 100 ± 16)

PDI: Psychomotor Development Index (population M = 100 ± 16)

having an MLU of 1.8 and the children not PEC having an MLU of 1.9. MLU results are provided in Table 2.

African -American English Dialect Pattern Usage. All of the children in the present study (as well as the larger study) were reared in homes where AAE dialect features were consistently used. Parental AAE dialect feature usage was detailed through caregiver report and later confirmed during observation of videotaped interview of the parent describing their children's language development. A checklist of the 15 AAE grammatical and phonological features commonly discussed in literature was developed by the author to code caregivers AAE dialect feature usage. The AAE features used were: production of /d/ for /ð/ in word initial position, production of /f/ for /θ/ and /v/ for /ð/ in word-medial and final positions, devoicing of final voiced consonants, dropping of /g/ in -ing word endings, final consonant cluster reduction, absence of past-tense marker, different irregular verb uses, completive done, habitual be, remote time been, absence of auxiliary and copula be, nonstandard subject verb agreement, multiple negation, absence of possessive -s marker and absence of plural -s marker (Craig & Washington, 1994; Stockman, 1996a; Wolfram & Fasold, 1974; Wyatt, 1995) Caregivers who consistently used six or more of the 15 AAE features were identified as AAE dialect users.

Data Collection

Spontaneous language samples served as the primary source of data. Clinicians, blinded to the exposure status of the participants, elicited 90-minute naturalistic language samples across a variety of play contexts (e.g., child alone, child and caregiver, child and clinician) in the Boston City Hospital (BCH) Laboratory. These episodes provided an opportunity to observe the child's language in varying contexts. Children were provided with a variety of developmentally appropriate toys, such as stacking rings; pots, pans, and dishes, Sesame Street figurines and playhouse; a baby doll with a bottle and blanket; and cars.

The language sampling sessions were video- and audio-recorded. Video equipment was placed in an adjoining room separated by a one-way mirror. Filming was accomplished by a fixed overhead camera in a corner of the BCH assessment laboratory. Video equipment included a Panasonic WBD5100 camera connected to a Panasonic AG6300 industrial type video recorder, Sony PVM1910 monitor and Shure M2627 mixer and sound system. Two Sony microphones were used, one in the ceiling and a second lavaliere microphone worn by the child.

Utterances obtained across all language sampling contexts were combined and at least 100 utterances were obtained for

each child's composite sample. Utterances were orthographically and phonetically transcribed from the videotapes according to procedures described by Miller (1981). Transcripts included preceding and following adult utterances and contextual information to capture all aspects of the communicative interaction. Two experienced graduate clinicians, masked to the toddlers' exposure status, independently transcribed the samples using broad transcription of International Phonetic Alphabet (IPA). The segments of each word were marked with diacritic marks or verbal descriptions to indicate nonstandard allophones. From the 100-utterance sample, words were randomly extracted and transcribed for phonological analysis resulting in a mean of 100 words. The number of different adult lexical types in the sample was 89 (58-106).

Agreement. As previously stated, all language samples were transcribed by one of two graduate student clinicians and checked for accuracy by the other student. Inter-judge reliability for utterances between the two students was judged to be 92%.

Phonological analyses. The procedure for choosing the targets for phonological analysis entailed randomly selecting words from the beginning, middle, and end segments of the 150-word sample. One hundred words were extracted and utilized for analysis using the Interactive System for Phonological Analysis (ISPA). The decision to use a 100-word sample in the current study was based on a procedure described by Dyson (1988) and Stoel-Gammon (1987), in which 50 utterances were sufficient for phonological analyses[1].

The 100-word sample obtained for each child was then analyzed using Masterson & Pagan's (1993) ISPA. Samples were analyzed to establish an inventory of phones used in initial, medial, and final positions. Using a predetermined formula based on Ingram's (1981) Criterion of Frequency (COF) analysis approach, individual phones were also classified as to whether they were "frequent," "used," or "marginal" (Masterson & Pagan, 1993). Under this approach, a phone is classified as "used" if the phone occurs twice in at least two different words. "Marginal" phones are those that do not satisfy the criterion for the "used" category but appear at least once in any word position. "Frequently" occurring phones are those that appear with a high degree of consistency in all word positions.

ISPA data were then analyzed to identify use of commonly displayed phonological process patterns. Error speech sound productions were classified according to the 21 phonological processes listed in the Appendix. Productions that were potentially representative of normal dialect use patterns (e.g., vocalization of /r/) were counted as errors and classified according to one of the phonological processes listed in the Appendix. Although ISPA also captures idiosyncratic substitution patterns that do not correspond to the program's existing taxonomy, there were no idiosyncratic patterns exhibited by any of the participants in this study. The total number of occurrences and opportunities, as well as average percentage of use of each process, was computed for each individual subject.

Finally, an analysis of word shapes was conducted. ISPA determined the frequency, total number of occurrences, opportunities and average percentage of use of five word shapes: (a) CV (e.g., /pʌ/), (b) other monosyllables, such as VCC (e.g., /æsk/), (c) CCV (e.g., /skai/), (d) CVC (e.g.,/pæt/), and (e) other closed syllable types. The data obtained from all three analyses (phone inventory, phonological process use, and word shapes) was then collapsed into group data (PED vs. non-PED) and compared

Results

In addition to obtaining group data on phonetic inventory, frequency of phonological process, and word shape use as well as computing a mean percentage of phonological process and word shape occurrence, *t* tests for significance were conducted for all group comparisons on phonological process and word shape use. Using the standard significance level of $p = .05$, 18 *t* tests comparing group means for phonological process use and four *t* tests comparing group means for word shapes were conducted. Retrospective power analyses were also conducted on the phonological process data to determine whether limited power, due to the small sample sizes, could potentially explain the lack of difference between groups on any of the 18 examined phonological process patterns.

Given the quantity of individual *t* test conducted for the phonological process analyses, a Bonferoni correction was applied to avoid spurious findings. Preliminary analyses suggested that for this data set, power was a greater issue than family wise error because of the small sample size in this study. Specifically, there was a risk that the tests could fail to reveal a significant difference when in fact there was one. Given this, the data analysis strategy was to maximize the chances of detecting differences and to carefully examine the power and effect sizes to help draw appropriate conclusions from null findings.

Phonetic Inventory Analyses: Profiles of each group's phonetic inventory are shown in Table 3. An analysis of the phonetic inventories produced by all subjects in both groups revealed marginal use of the following phones: [p, b, t, d, k, g, m, n, ŋ, f, v, ʍ, h, w, j, s, z, ʧ, ʤ, θ, ð, ʔ, r, l] children PEC and 75% (6/8) of the non-PEC children.

Phonological Process Analyses

An analysis of phonological process patterns revealed the use of 18 different processes by the children non-PEC and 17 by the children PEC. Table 4 displays the phonological processes identified, the total number of occurrences and opportunities for each process, and mean percentage of occurrence for each group. According to ISPA, the five most frequently used phonological processes for the non PEC group included cluster reduction (77%), final consonant deletion (41%), stopping of affricates (25 %), gliding of liquids (24%) and vocalization of /r/ (22%). The five most frequently occurring processes used by the children PEC were cluster reduction (74%), final consonant deletion (47%), gliding of liquids (22%), stopping of fricatives (19%) and vocalization (17%) more frequently than other processes (see Figure 1).

A total of 18 individual *t* tests were used to compare the groups' mean frequency of phonological process usage. The normality of the sample was assessed via use of a Shapiro-Wilkes

[1] The procedure of the current study exceeds that used in other studies of PED as well as non-exposed children's phonological development (Crary, 1983; Madison et al. 1998). Such studies found that phonological process analyses on samples of at least 50 words resulted in information similar to that of 100 word samples.

Table 3. Comparison of phones produced at least once in initial (I), medial (M), and final (F) word position by non-exposed and exposed groups

	Non-exposed (n=8)			Exposed (n=10)		
Phone	I	M	F	I	M	F
m	+	+	+	+	+	+
n	+	+	+	+	+	+
ŋ	N/A	+	+	N/A	+	+
p	+	+	+	+	+	+
b	+	+	-	+	+	-
t	+	+	+	+	+	+
d	+	+	+	+	+	+
r	N/A	-	N/A	N/A	+	N/A
k	+	+	+	+	+	+
g	+	+	+	+	+	-
ʔ	N/A	+	+	N/A	-	+
tʃ	+	-	-	+	+	+
dʒ	+	-	+	+	-	+
f	+	+	+	+	+	+
v	-	+	+	+	+	+
θ	+	-	+	+	-	-
ð	+	-	-	+	-	-
s	+	+	+	+	+	+
z	+	-	+	+	-	+
ʃ	+	+	+	+	+	-
h	+	-	N/A	+	+	N/A
r	+	+	N/A	+	+	N/A
ɚ	N/A	+	+	N/A	+	+
l	+	+	N/A	+	+	N/A
ɫ	N/A	-	+	N/A	-	+
ʍ	+	-	N/A	+	-	N/A
w	+	+	N/A	+	+	N/A
j	+	+	N/A	+	+	N/A

N/A = Not applicable

Table 4. Mean percentage of 18 phonological processes used by non-exposed and exposed groups

	Non-Exposed				Exposed			
Process	Opp/Occ	Mean	SD	Range	Opp/Occ	Mean	SD	Range
Final Consonant Deletion	150/371	.41	.18	12-23	219/481	.47	.15	13-35
Cluster Reduction	107/142	.77	.14	5-19	137/187	.74	.16	6-19
Syllable Deletion	25/168	.16	.15	0-9	26/210	.15	.09	1-6
Initial Consonant Deletion	54/607	.10	.09	1-20	55/708	.08	.06	2-11
Labialization	10/556	.02	.01	0-4	20/706	.03	.03	0-5
Fronting	20/515	.06	.05	1-10	36/766	.05	.03	0-12
of Palatals	3/46	.05	.09	0-1	5/74	.06	.11	0-2
of Velars	26/132	.20	.20	1-10	22/201	.11	.10	0-11
Apicalization	8/425	.02	.04	0-7	5/491	.01	.02	0-2
Interdentalization	2/143	.01	.04	0-2	0/143	.00	.00	0
of Alveolar Fricatives	0/117	.00	.00	0	0/116	.00	.00	0
of Palatal Fricatives	2/15	.20	.45	0-2	0/10	.00	.00	0
of Affricates	0/9	.00	.00	0	0/15	.00	.00	0
Stopping	51/287	.18	.11	0-14	63/321	.19	.12	0-13
of Fricatives	52/278	.17	.12	0-14	59/307	.19	.12	0-12
of Affricates	2/9	.33	.52	0-2	4/14	.23	.27	0-3
Denasalization	2/262	.01	.03	0-1	4/387	.01	.03	0-2
Deaffrication	0/9	.00	.00	0	11/16	.15	.22	0-1
Gliding of Liquids	22/91	.24	.18	0-10	27/122	.22	.19	0-7
Vocalization	17/108	.19	.17	1-6	20/121	.17	.09	1-4
of /r/	21/95	.22	.17	1-6	21/105	.20	.12	0-4
of /l/	0/13	.00	.00	0	1/16	.05	.12	0-1
Place and Manner Assim	128/2605	.04	.03	1-38	150/3045	.05	.02	5-30
Assim of Bilabials	1/246	.01	.01	0-1	3/316	.03	.04	0-4
Assim of Labiodentals	1/51	.00	.02	0-1	0/39	.00	.00	0
Assim of Interdentals	0/65	.00	.00	0	0/65	.00	.00	0
Assim of Alveolars	69/330	.019	.015	0-30	51/398	.12	.07	1-11
Assim of Palatals	2/156	.01	.02	0-1	3/209	.02	.03	0-1
Assim of Velars	0/124	.00	.00	0	2/160	.01	.03	0-1
Assim of Glottals	0/68	.00	.00	0	0/78	.00	.00	0
Assim of Nasals	4/187	.03	.05	0-2	3/220	.02	.03	0-1
Assim of Stops	21/296	.05	.05	0-8	34/363	.01	.06	0-7
Assim of Fricatives	1/239	.00	.01	0-1	4/238	.02	.04	0-2
Assim of Affricates	0-13	.00	.00	0	0-19	.00	.00	0
Assim of Liquids	0/232	.00	.00	0	0-262	.00	.00	0
Assim of Glides	0/95	.00	.00	0	0/110	.00	.00	0
Prevocalic Voicing	13/248	.06	.07	0-6	30/283	.11	.06	0-8
Final Consonant Devoicing	9/247	.04	.05	0-5	15/285	.05	.09	0-6

Assim = assimilation

Opp = opportunities Occ = occurrence

Results: $t(16) = .63$, $p > .05$ = No Statistical difference.

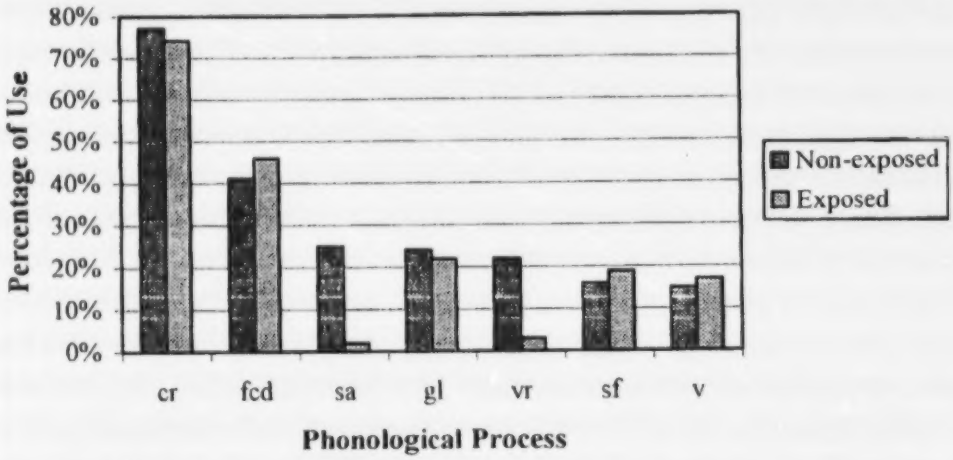

Figure 1. Comparison of the most frequent used processes.

Key
cr = cluster reduction
vr = vocalization of /r/
fcd = final consonant deletion
sf = stopping of fricatives
sa = stopping of affricates
v = vocalization
gl = gliding of liquids

univariate analysis, prior to testing the group means for significance. Results indicated that the sample had a normal distribution. Results from t test comparisons revealed no significant differences between the groups at the .05 level of confidence.

Phonological patterns used by subjects in both groups were examined to determine whether children used patterns that might be dialect based (typical of AAE). At least three of the five most frequently occurring patterns used by both groups (cluster reduction, final consonant deletion and vocalization of /r/), have been cited as typical phonological patterns in AAE (Bailey & Thomas, 1998; Stockman, 1996a). However, given the fact that these three processes are also common developmental patterns in the speech of all English speaking toddlers, the presence of these phonological patterns cannot be exclusively attributed to AAE dialect use.

Word Shapes

The mean percentages of occurrence for each word shape are summarized in Table 5. Overall, word shape profiles for both groups were similar when group data were collapsed and compared across use of CV, CVC, other monosyllables and closed syllables. When individual word-shape types were compared, it was found that both groups of children used the CV word structure more than CVC. Four individual *t* tests comparing the children PEC and the children non-PEC mean frequencies of occurrence of syllable shapes revealed no significant differences ($p < .05$).

Sample and Effect Size Analyses

As previously reported, individual *t* test of the phonological processes indicted that there were no statistically reliable differences between the two groups. However, given the small sample size it was possible that limited power could explain these findings, rather than a lack of difference. To explore this possibility further, retrospective power analyses and effect sizes were conducted. For 15 of the 18 processes observed, the difference between the two groups was either 0 or in the wrong direction, with children non-PEC displaying more frequent use of examined phonological processes. Children PEC displayed more frequent use of phonological processes when compared to their exposed counterparts on the remaining variables.

Using Cohen's (1992) procedure, the sample size that would be necessary to achieve power of .80 for each variable, given the current effect sizes, was estimated for each variable. Effect sizes between 0 - .35 can be considered small, .36 - .65 can be considered medium, and .66 - 1 can be considered large. Results revealed most effect sizes for these phonological processes to be small (average d = .14).

Variables with small effect sizes were final consonant deletion, fronting of palatals, stopping of fricatives and affricates, and devoicing final consonants. Variables with the smallest effect sizes would have required close to 500 children per group for adequate power to be achieved. The small effect sizes seen and the large size of samples needed for establishing significance suggested that the differences observed were due to chance, not inadequate power.

Two phonological processes, deaffrication and assimilation of stops, had considerably large effect sizes (d = .94 and .83 respectively). Other phonological processes with large effect sizes included assimilation of stops (d= .83), prevocalic voicing (d= .67), assimilation of fricatives (d = .67), and assimilation of bilabials (d= .67). According to retrospective power analyses, three of these variables (assimilation of bilabials, assimilation of fricatives, and prevocalic voicing) would require a sample size of at least 40 children to achieve sufficient power. Assimilation of stops and deaffrication would require less than 25 children per group to achieve sufficient power. Overall, results suggest that the failure to find statistically significant differences on the above listed variables may be due to lack of power and that real differences may in fact exist between the two groups on these variables.

Discussion

While some studies have reported evidence of language delays in toddlers PED, others have not found any differences between the language development of children PED. Findings from this study support the latter notion, in particular in the area of phonological development. Specifically, the results of the study revealed that the phonetic inventories of AA children PEC and AA children non-PEC were similar, with the following 25 sounds produced marginally by most or all children in both groups [p, b, t, d, k, g, m, n, ŋ, f, v, h, ʍ, w, j, s, z, ʧ, ʤ, θ, ð, r, l, ʔ]. The phones The phones present in both groups' phonetic in-

Table 5. Mean percentage of word shapes examined

	Exposed	Non-exposed
Word Shape	Mean Percentage	Mean Percentage
CV	39%	36%
CVC	19%	24%
Other Monosyllables	77%	80%
Closed Syllables	32%	39%

ventories are also consistent with those cited in the literature for typically developing English speaking two-year-olds. Both groups also displayed the ability to produce a variety of word and syllable shapes, such as CV, CVC, VCC, CCV, and other closed syllable types. These word and syllable shape patterns are similar to those reported for typically developing SAE speaking children (Dyson, 1988; Stoel-Gammon 1985, 1987). In addition, when comparing the number of phonological processes used between the children PEC and children non-PEC, individual t test were unable to detect significant group differences at the .05 level for all of the phonological processes.

Findings from this study contradict those from studies suggesting that toddlers PED are more likely than their non-PED counterparts to exhibit restricted phonemic inventories, more simplistic word shapes, and more frequently occurring phonological processes (Bullock, 1994; Madison et al., 1998; Mentis et al., 1994).

Although *t* test comparisons revealed no statistically reliable difference between the two groups on phonological process use, retrospective power analysis and effect size (d) measures were conducted to determine whether limited power might explain group findings and also whether a larger sample size would yield statistically significant results. Results from a power analysis revealed large effect sizes for six variables examined (deaffrication, assimilation of stops, prevocalic voicing, assimilation of fricatives, interdentaliztion, and assimilation of bilabials) as well as medium effect sizes for five variables (vocalization of vowels, assimilation of place and manner, assimilation of palatals, assimilation of velars, and prevocalic voicing), indicating the lack of significant group differences may have been due to lack of power for some of the variables examined.

In addition to investigating whether any of the phonological patterns produced by the AA toddlers PED in this study reflect patterns of delay or disorder, this study also considered the role that home dialect AAE use patterns might play in the types of phonological patterns displayed by both groups. Given that toddlers in both groups were being reared in homes and communities where adults reported and were observed to use forms of AAE, it was hypothesized that children in both groups might display speech production patterns that distinguish them from those reported for typically developing toddlers PED acquiring SAE as their first dialect.

An examination of phonological process patterns did in fact reveal patterns that could be possibly attributed to emerging dialect in both groups. Both groups of toddlers displayed frequent use of consonant cluster reduction and final consonant deletion processes which may be precursors to later developing features of AAE phonology as delineated by Bailey and Thomas (1998), Stockman (1996a), and Wolfram (1994). However, it is not clear whether the frequent use of these two processes can be exclusively attributed to normal dialect influences, as they are also common features of typically developing speech in SAE speaking toddler populations. These findings suggest, as has been noted by Stockman and Settle (1991) and Cole (1980), it is not always possible to distinguish between dialect and developmental influences when analyzing the phonological and grammatical productions of AAE child speakers under the age of three years.

There are additional limitations that must be considered when interpreting results. One important consideration is the classification criteria employed by the ISPA software. All phones produced by the toddlers in this study were "marginally" used according to ISPA standards. ISPA classifies a sound as marginally used if it occurs at least once in any word position. This contrasts with other classification systems that insist in order for a sound to be considered as used, two productions must occur in at least two different words. It is possible that the toddlers' phonemic inventories, as determined by ISPA, may include phones that were not yet well established in their developing inventories. The results may have been different if a more stringent criterion for use had been implemented.

Second, phonological analysis was conducted on 100 words. Although a sample of 50 to 100 words has been described as a representative sample size by Stoel-Gammon (1987) and Madison et al. (1998), it is plausible that a larger sampling of productions may have provided different results. A sample of 100 words may not have provided children enough opportunity to produce all existing phones in all word positions. In other words, children may have the ability to produce more phones, but not within the confines of the extracted sample. Also, in this study, speech sound productions were transcribed using a broad rather than a narrow transcription framework, thus some data may have been lost. Utilization of narrow transcription may provide a more comprehensive representation of the children's phonological systems.

The small sample sizes of both groups also limits generalization of findings from this study to the larger population. Power analyses highlighted the need to conduct similar studies on larger samples with equal numbers of participants in the control and experimental groups.

The use of children PEC who were born full-term may have also affected results. Findings may have been different if toddlers PEC who were born prematurely were included in this study. These types of children make up a significant portion of the PED population. In addition, even though subjects in both groups were matched for several background variables such as age, home dialect background, level of maternal education, and socioeconomic status (SES), the groups were unequally matched in terms of gender with the children PEC having higher numbers of boys than girls. Although the role of gender has not yet been examined in previous studies of phonological development in PED populations, it is possible that group comparisons may have revealed differing results if the gender distribution of the two groups had been the same.

Another potential limitation is group differences in caregiver status. While all of the toddlers non-PEC were living with their biological mothers, two of the toddlers in the PEC group were living with non-biological parents.

The focus of this study was on the potential use of AAE dialect patterns with no consideration of other possible regional dialect influences. The latter is significant given the fact that all of the children were growing up in the Boston area where regional dialect influence patterns may also have impacted on some of their speech sound productions. In some speech communities, where co-existing dialect systems exist, it is highly possible for one to influence the other or for both to develop linguistic innovations that distinguish populations in that community from other communities. As noted by Bailey and Thomas (1998) and Wolfram (1996), these regional influences can lead to phonological and grammatical patterns that distinguish AAE speakers in certain parts of the country (e.g., rural Southern) from those in other parts (e.g., northern urban).

Clinical Implications and Directions for Future Research

While the findings of this study do not seem to support the notion that prenatal cocaine exposure leads to delays in phonological development for AA toddlers who are emerging speakers of AAE, it would be a mistake to assume that these toddlers are not at risk for later phonological delays or difficulties. Results fr[illegible] post-hoc power analyses reveal that with a larger subject sample, differences that do not appear to be evident in the current population may in fact become apparent. There are also a number of research studies that have documented later emerging speech and language and academic learning concerns in children PED once they enter their later school-age years.

In addition, it is highly possible that as both groups of children mature, some of the phonological processes produced by children in both groups but not typically associated with AAE (e.g., velar assimilation, stopping of affricates and gliding) may eventually distinguish the exposed children in this study from their non-exposed AAE speaking peers. By the end of their school-age years, all three of these processes are likely to have disappeared in the speech of typically developing AAE users. The distinction between dialect and disorder may also become more evident as the toddlers in this study move into their preschool- and school-age years.

Until there is clear consensus regarding the effects of cocaine exposure on the speech development of AAE speaking preschoolers, clinicians should proceed with caution when evaluating the phonological skills of exposed toddlers. The possibility of later appearing phonological delays and deficits should prompt clinicians to provide ongoing monitoring and assessment of toddlers PED, regardless of their cultural or language background. Specifically, it is recommended that periodic assessments be conducted on at least an annual basis, until children reach an age of development (e.g., 8 years of age) where their phonemic inventories should have stabilized, normally occurring phonological processes should have disappeared, and the distinction between dialect and development becomes more clear. It is also important that speech language pathologists consider the role that undetected phonological difficulties may play on the later development of phonological awareness and reading skills. The relationship between early phonological difficulties and later reading abilities has been well-established (Catts, 1977; Catts, 1999; Catts, Fey, Zhang & Tomblin, 1999; and Kamhi, 1999).

When working with children PED who are emerging speakers of AAE, clinicians must be familiar with the phonological rules of AAE and how AA children acquire the phonological characteristics of their native dialect system. Assessment procedures of AAE speakers should be similar to those proposed by Seymour et al. (1998), Stockman, (1996b), and Wyatt (1998). Such assessments should focus on universally shared or non-dialect specific aspects of phonological development and should take into consideration the potential role of variable rule constraints on phonological productions.

The field would also benefit from longitudinal studies on the phonological development of children PED from all English dialect backgrounds as they progress from the early stages of phonological development to their later school years. In addition, future research should also utilize larger sample sizes that are carefully controlled for factors such as regional dialect influences, drug-exposure history, caregiving status (e.g., biological or foster parent), birth status (pre-term or full term), and medical/health status.

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A 17

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APPENDIX: DEFINITIONS OF PHONOLOGICAL PROCESS*

Final Consonant Deletion (FCD):	Any word in which a final consonant is deleted (e.g., "house" produced as [hau]).
Cluster Reduction (CR):	The elimination or substitution of one or more consonants in a cluster of two or three consonants (e.g., "tree" produced as [twi] or [ti]).
Syllable Deletion (SD):	Any word in which the vowel is omitted (e.g., "banana" produced [naena]).
Initial Consonant Delection (ICD):	Any word in which the initial consonant is deleted (e.g., "feet" produced as [it]).
Labialization:	Any word in which a labial consonant replaces an alveolar or interdental consonant (e.g., "they" produced as [ve]).
Fronting of Palatals:	Any word in which a palatal sound is substituted by a sound made more forward in the mouth (e.g., "shoe" produced as [su]).
Fronting of Velars:	Any word in which a velar sound is substituted by a sound made more forward in the mouth (e.g., "cake" produced as [tek]).
Apicalization:	Any word in which an alveolar is substituted for a labial (e.g., "bow" produced as [do]).
Interdentalization:	Any word in which target production is replaced by an interdental fricative.
Stopping:	Any word in which a fricative or affricate is replaced by a stop (e.g., "seat" produced as [tit]).
Denasalization:	Any word in which a nasal consonant is replaced by a homorganic non nasal (e.g., "no" produced as [do]).
Deaffrication:	Any word in which a fricative replaces an affricate (e.g., "cheese" produced as [siz]).
Gliding of Liquids:	Any word in which a liquid is placed as a glide (e.g., "rake" produced as [wek]).
Vocalization:	Any word in which a liquid is replaced by a vowel (e.g., "apple" produced as [appo]).
Assimilation of Place and Manner:	Occurs when a sound is influenced by another sound in a word (e.g., "take" produced as [kek]).
Prevocalic Voicing:	Any word in which an unvoiced consonant becomes voiced when it precedes a vowel (e.g., "pen" produced as [bEn]).
Devoicing of Final Consonants:	Any word in which a voiced obstruent becomes devoiced when it is at the end of a syllable (e.g., "made" produced as [met]).

**Summarized from the works of Ingram (1976) and Lowe (1994).*

The Early Reading Screening Instrument: A Spanish Translation and Preliminary Study of Three Bilingual Children

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ABSTRACT: *The Early Reading Screening Instrument (Morris, 1992) measures reading readiness skills, including alphabet recognition, concept of word, word recognition of basal and decodable words, and invented spelling. In a preliminary study, the ERSI was translated into Spanish and administered to three bilingual Spanish-English speaking children in the second half of their kindergarten year. Testing was conducted in English and in Spanish to determine whether bilingual children develop phonological awareness and pre-reading skills differently within each language, or in a way that is different from monolingual English-speaking children. Results indicated that overall reading readiness skills of bilingual children appear to be about the same as those of monolingual children previously studied. Some differences of abilities in English and Spanish were noted for bilingual subjects. This preliminary study indicates that the ERSI is a good indicator of reading readiness for bilingual children who are able to participate normally in an English-speaking classroom.*

KEY WORDS: *Reading, Bilingual, Phonological Awareness, Spanish*

Phonological awareness is a broad descriptor for different levels of sensitivity to sound segments in a language. It has come to be recognized as the single most important skill for acquiring fluent reading in an alphabetic language (Wagner & Torgesen, 1987; Goswami & Bryant, 1990, 1992; Morais, 1991; Gough, Juel & Griffith, 1992; Treiman, 1994). The well-established link between phonological awareness skills and reading ability (Bradley & Bryant, 1983; Blachman, 1984; Wagner & Torgesen, 1987) leads naturally to the investigation of this association in children who speak more than one language.

Phonological awareness refers to the ability to reflect on speech and segment it into its phonological constituents (Treiman & Zukowski, 1996). Syllabic level tasks require children to segment words into syllables (e.g., Tap out the number of beats you hear in the word baseball). Onset-rime level tasks require children to attend to the beginning or onset of a word (i.e., sounds prior to the vowel sound), or the end or rime of a word (e.g. What is the first sound you hear in the word catch? or What does it sound like when you say horse without the /h/?). Phonemic awareness requires segmentation at the smallest unit of analysis (e.g., How many sounds do you hear in the word fish?). The phonemic level of analysis is important in word decoding skills because it is at this stage of phonological awareness that children learn to associate specific sound-letter patterns and sequences, (e.g., naming both phonemes in word-initial consonant clusters, such as pr-) (Treiman & Zukowski, 1996). Children need to have phonemic awareness skills in order to translate phonemes into graphemes (Muter, 1998). In English-speaking children, phonological awareness is acquired first with larger units of speech, and later in smaller sound segments (Adams, 1990; Treiman & Zukowski, 1996). Thus, larger constituents, such as the syllable, are accessible to children before smaller constituents, such as the phoneme.

Cross-cultural studies in phonological acquisition have re-

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vealed some language-specific patterns in the development of phonological awareness (Cossu, Shankweiler, Liberman, Katz & Tola, 1988; Caravalos & Bruck, 1993). Cossu et al. (1988) found that Italian-speaking children had higher syllable and phoneme awareness than English-speaking children. In a study of 220 preschool, kindergarten, and first- and second-grade Italian children, subjects were asked to tap out syllables or phonemes of words, as in a previous study of English-speaking children conducted by Liberman et al. (1974). Like children in the Liberman study, Italian preschool and kindergarten children were better at identifying syllables than phonemes; however, the Italian-speaking children made fewer errors on both syllable and phoneme tasks than were reported for English-speaking children. Italian grade-school children were at ceiling on both syllable and phoneme tasks, whereas English-speaking grade school children were not. Superior Italian performance on the tasks was attributed to language structure and orthography. Frequency of open syllables and multisyllabic words in Italian combined with transparent orthography appeared to increase awareness of individual phonemes once the alphabetic principle is introduced.

Caravalos and Bruck (1993) studied 100 Czech-speaking and 101 English-speaking children in three age groups: pre-kindergarten, kindergarten and first grade to examine language-specific effects on phonological awareness. They administered a sound isolation task that required manipulation of onset consonants in CVC and CCV syllables, and found that Czech-speaking pre-kindergarten and kindergarten-aged children were better at manipulating sounds within an onset consonant cluster than their English-speaking peers. However, the English-speaking children at all grade levels were better able to manipulate onsets in CVC syllables. Because differences that emerged were noticed well before alphabetic knowledge was taught, they are proposed by the authors to be a result of oral-language input. That is, because Czech has more onset clusters than English, Czech-speaking children are better at manipulating members of onset clusters than English-speaking children. Conversely, because English-speaking children learn to manipulate onset consonants by 4 years of age, they continue to have greater facility with it than Czech-speaking children.

Few studies to date have examined phonological awareness in bilingual populations. However, there has been a long-running debate on whether advantages or disadvantages exist for bilingual children over monolingual children on tasks involving metalinguistic awareness (Cummins, 1978; Bialystock, 1988; Galambos & Goldin-Meadow, 1990; Bruck & Genessee, 1995; Clyne, 1997). Supporters of a bilingual advantage propose that acquiring two languages requires children to perform a kind of linguistic constrastive analysis, examining language structures to a greater degree than monolingual children (e.g., Cummins, 1978). More recently, this debate has extended to the nature of phonological awareness skills in bilingual children versus monolingual children (Durgunoglu, Nagy & Hancin-Bhatt, 1993; Bruck & Genesee, 1995; Cisero & Royer, 1995). Some researchers have argued that bilingual children have an advantage in phonological awareness because they may have increased awareness of the individual phonological units of each system as they learn to distinguish the two systems (Walley, 1993; Bruck & Genesee, 1995).

Bruck and Genesee (1995) studied 91 English-speaking kindergartners who attended a French-speaking school and 72 English-speaking kindergartners attending an English-speaking school. The children were presented with a variety of phonological awareness tasks designed to assess syllable awareness, onset-rime awareness and phoneme awareness. Results indicated that the bilingual children performed better on tasks involving onset-rime awareness, but that performance on other tasks was not significantly different from the monolingual children. When the same children were re-tested in first grade, the monolingual group performed better on phoneme counting tasks than the bilingual group, and the bilingual group performed better in a syllable counting task. The bilingual advantage in syllable segmentation was attributed to the salience of the syllable in French, which has many multi-syllabic words and open syllables. The bilingual advantage held even for kindergartners with relatively low proficiency in the second language. Higher phoneme awareness in monolingual children was attributed to orthographic education in English.

Measuring equivalent phonological awareness abilities in the two languages of bilingual children is complex because phonological awareness has a developmental hierarchy, which may interact with the salient features of a given language (Caravalos & Bruck, 1993; Bruck & Genesee, 1995). For example, the extensive use of coda consonants and coda consonant clusters in English (consonants that follow a vowel in the same syllable, e.g. the /t/ in cat, /nts/ in sprints) compared with the relatively small set of coda consonants in Spanish may facilitate the perception of those sounds in young learners of English. Although Yavas and Gogate (1999) found that segmentation of some coda consonants, especially sonorant consonants, remains a challenge for some first-graders, the task may be easier for bilingual children because of the phonotactic differences for coda position in the two languages. The structures and sounds of English coda consonants may serve to direct extra attention to that word position in children whose native language structure and sounds are very different. Yavas and Core (1999) found that Spanish-English speaking bilingual first-graders had less difficulty segmenting singleton coda liquids than their monolingual counterparts.

In addition to oral language input influencing phonological awareness development, Caravolos and Bruck (1993) suggested that a more transparent orthography with closer grapheme-phoneme correspondences than English may reinforce early readers' phoneme segmentation skills. Transparency of orthography refers to the number of one-to-one sound-symbol relationships. Shallow orthographies have more regular correspondences and are called transparent. Less regular orthographies are sometimes called deep. The English orthographic system is less transparent than Spanish, which is much more faithful to the phonemic principle. That means that Spanish has more one-to-one phoneme-grapheme relationships. For example, in English, the grapheme "th" represents two distinct phonemes,/ð/ and/θ/, and the sound /ə/ can be represented by several vowel graphemes, including "a", "e", and "o". In Spanish, most graphemes represent one phoneme, and in a few cases, two graphemes represent one phoneme, for example, "z" and "s" both represent /s/, and "v" and "b" both represent /b/. For children learning to read Spanish, acquisition of the ability to segment phonemes gives children the ability to decode the majority of words they read. Further, Spanish and English differ in their phonemic make-up and their distribution of phonemes, or phonotactic constraints. For example, (1) Spanish allows liquids, the nasal /n/ and the obstruents /s/ and/ð/ in word-final position, whereas English uses a wider variety of consonants, especially obstruents, as singletons in the word-final position, (2) Spanish does not permit word-final consonant clusters, while English permits structures such as -VCCC, as in the word "sprints," and (3) Spanish has a preference for CV syllables, with few CVC words in the language,

whereas English CVC words, such as "bag" and "boat," are considered to be acquired early and are used in language testing of young children.

As the effect of bilingualism on reading readiness and phonological awareness skills is not yet understood, studying reading readiness and phonological awareness in bilingual children might allow us to establish patterns of development that are different from those seen in monolingual children. This information would be helpful in determining whether a child's difficulty in learning to read is a function of his/her language difference or is a symptom of a specific reading disability. Using an assessment tool such as the Early Reading Screening Instrument (ERSI) to evaluate reading readiness in bilingual children may give insight into the influence of bilingualism on these critical skills.

The ERSI is a reading readiness measure that was developed by Morris (1992), and administered by Lombardino et al. (1999) to 149 children in Alachua County, Florida, during the second half of their kindergarten year. The ERSI measures alphabet recognition, concept of word, word recognition of basal and decodable words, and invented spelling. Children's performance on this test was found to correlate with their grade reading achievement at the end of first grade (Lombardino et al, 1999). The invented spelling task measures phonemic awareness through the assessment of grapheme-phoneme correspondences in print. Eckert (1999) re-tested a subset of these children six years later and found that ERSI scores from kindergarten, particularly invented spelling scores, continued to be good predictors of phonological skills ($r = .65$).

Hence, it is clear that the ERSI is an adequate tool for identifying monolingual English-speaking children who are at risk for a reading disability. A logical extension of this work would be to assess the efficacy of using the ERSI when testing bilingual children. This study was designed to examine phonological awareness and early reading skills in young Spanish-English speaking bilingual children to investigate differences in these skills between bilingual and monolingual children. One goal of the study was to determine if bilingual Spanish-English speaking kindergarten children perform similarly to monolingual children on the ERSI when it is administered to bilingual children in both English and in Spanish, in order to determine whether the ERSI is a suitable screening instrument for use with bilingual children.

Method

Instrument: The ERSI was translated into Spanish by the first author (see Appendix A). After the test was translated, it was presented to a native Spanish-speaking bilingual Speech-Language Pathologist (SLP) for review of the translation and appropriateness of word items for kindergarten-aged children. The translation was also reviewed by a professor of Linguistics at Florida International University who is familiar with evaluating child phonology in Spanish and English, and with phonological and orthographic structures of Spanish and English. For more details on each of the subtests, see Mercado, Lombardino and Pinheiro (1998). A description of the procedures used to translate the ERSI into its Spanish equivalent follows.

Alphabet Recognition: Graphemes of the Spanish alphabet upper and lower case were represented on a table similar to the English version.

Concept of Word: Katie's Story and My Home (Melser, 1981) were translated into Spanish and the Spanish text was affixed over the English text in a way that children could access either version.

Word Recognition: Ten basal words and ten decodable words were selected. They were chosen from Spanish children's books for preschoolers, so they are believed to be age-appropriate for kindergartners. The words for both sections are composed of either three or four phonemes, seen in English words. However, unlike the majority of English words (CVC), most Spanish words are disyllabic with CVCV structure. The basal words selected are high-frequency words that are not easily decodable. Decodable words were chosen based on their one-to-one grapheme/phoneme correspondence.

Invented Spelling: Words were selected from Spanish language children's books. Items were matched with the words from the English version for number of phonemes per word and transparency of the orthography.

Scoring: A scoring system equivalent to the English system was developed based on the number of letters in the alphabet recognition task and the number and correctness of phonemes used in the invented spelling task.

On the *Invented Spelling* subtest, one correct phoneme receives one point, two correct phonemes receives two points, and so on. Conventional spelling is not given any extra points. Total spelling score for the Spanish version of the invented spelling task is 45 points (see Table 1). In the *Concept of Word* task, scoring procedures were the same as in the English test, and in the *Word Recognition* tasks, scoring was based on whether the child correctly named the word or not, as in the English version of the test.

Both Spanish and English versions of the ERSI are shown in the Appendices (A and B).

Subjects

Three bilingual Spanish-English speaking kindergarten children were selected to participate in this study to determine whether the ERSI translation is a suitable screening instrument for use on bilingual children. The children were recruited from a public school in Hialeah, in Miami-Dade County, Florida. Hialeah is a predominantly Hispanic inner-city community, in which Spanish is the dominant language. However, in the public schools, English is the official language of instruction. It is important to note that although many of the teachers are bilingual, English is spoken in the classroom. Outside the classroom, such as in the hallways and on the playground, Spanish is frequently spoken by children and teachers. In other words, this is truly a bilingual environment, in which children and adults use both languages fluently and interchangeably. The school is a Title I school with more than 80% of its children receiving free or reduced lunch. As a result, it is the recipient of programs designed to develop reading skills in at-risk children. Children in this study received formal instruction in phonological awareness and alphabet recognition during their kindergarten year through a Title I funded reading program.

Children were selected for participation by their classroom teacher based on criteria outlined by the examiner. The classroom teacher was asked to identify subjects who were "fully bilingual," meaning that they could speak and understand both languages at an age-appropriate level as judged by the teacher, a native speaker of Spanish and English. Subjects who had identified language or learning disabilities were not selected. The teacher reported that the children identified to participate spoke English and Spanish equally well conversationally, based on her experience in speaking with and observing the children interact with their peers. The children were described as "good begin-

Table 1. Scoring system for invented spelling task

Spelling Word	1 point	2 points	3 points	4 points
pato (duck)	P	PT, PA, PO	PTO, PAT, POT	PATO
sin (without)	S	SN, SI	SIN, SEN	
feo (ugly)	F	FE, FO	FEO, FAO	
rana (frog)	R	RN, RA	RAN, RNA	RANA
año (year)	A, N	AN, AO	ANY, AYO	ANYO, AÑO
taza (cup)	T	TS, TA, TZ	TAS, TSA	TASA, TAZA
vaca (cow)	B, V	BK, BC, BA, VC, VA	BAC, BCA, VCA, VAC	VAKA, BAKA, BACA
dice (says)	D, T	DS, DI, DE	DIC, DIS, DSE	DISE, DESE, DICE
pollo (chicken)	P, B	PU, PO, PY	POY, POLL, PYO	POYO, POLLO
corre (run)	K, C	KR, CR, CO, KO	COR, KOR, CRE	CORE, CORRE, KORE
mucho (a lot of/much)	M	MT, MCH, MU, MO	MOT, MOCH, MUCH, MUT	MUCHO, MUTO, MOTO
ven (come)	V, B	VN, BN, BE	BEN, VEN, BEEN	

ning readers." They ranged in age from 5:11 to 6:3. Two subjects were male and one was female. All children told the examiner that they spoke Spanish at home with their parents and English at school. The children did not name a preference for either language when asked by the examiner, and they spoke both languages fluently with the examiner with no signs of speech or language impairment during informal observation. Pronunciation abilities in English reflected influence from their native language characterized by final consonant devoicing and occasional final consonant deletion. This pronunciation style is recognized as a widely-spoken local dialect of English.

Procedure

Testing took place in a quiet, familiar classroom in sessions of approximately 40 minutes per child. The examiner, who is bilingual, though not a native speaker of Spanish, conducted testing in English and in Spanish. The ERSI was administered in English first, and when the English version was complete, in Spanish. Subtests were administered in the following order for both languages: alphabet knowledge, concept of word, word recognition, and invented spelling. To maintain consistency, when conducting the English testing, all instructions and reinforcements were given in English. During the Spanish version of the test, all instructions and reinforcements were given in Spanish, as reported in Gauger, Lombardino and Pinheiro (1998) and Lombardino et al. (1999). Results were recorded and raw scores were computed for each student. Scores were converted to base 10 scores and tallied for a total ERSI score. Subtest scores and total ERSI scores for Spanish and English were compared with the monolingual group mean scores (See Table 2).

Results

English total ERSI scores were higher than Spanish total scores for all three subjects. Two of the three children scored more than one standard deviation above the mean reported for the total English ERSI scores in Lombardino et al. (1999), and the third subject was at the highest end of the mean range for the total English ERSI score.

Subjects 1 and 2 performed similarly in English and in Spanish, with Spanish total scores falling within one standard devia-

Table 2. Spanish and English ERSI scores for bilingual subjects

Subject/ Task	Subject 1		Subject 2		Subject 3		Monolingual Norms Mean/SD
	Spanish	English	Spanish	English	Spanish	English	
Alphabet Recognition	7.5	10	6.3	10	7.2	10	8.58/1.95
Concept of Word	10	10	9.4	10	8.1	10	6.79/2.67
Word Recognition	9.4	10	4.0	6.0	0	5.5	2.16/2.70
Invented Spelling	10	10	5.3	5.7	2.2	4.8	5.11/2.72
Total ERSI Score	**36.90**	**40**	**25**	**31.70**	**17.5**	**30.30**	**22.67/8.67**

tion of English total scores, and English and Spanish scores less than one standard deviation apart. Subject 3 performed above the mean in English, and below the mean in Spanish, with a gap of more than one standard deviation between the two scores.

In the English version of the *Alphabetic Knowledge* subtest, all three children scored 10 (highest score possible). In Spanish, children scored somewhat lower, with subjects 1 and 3 scoring within one standard deviation of the monolingual mean scores. Subject 2 scored 6.3, which is slightly more than one standard deviation below the mean. Similarly, in the English version of the *Concept for Word* subtest, all children scored 10. Spanish scores were slightly lower, but still well within the normal to high range as reported for monolinguals.

On the Spanish version of the *Word Recognition* subtest, the score for subject 3 was 0, but her English score was 5.5, which was well above the reported mean for the monolingual group. Subject 1 scored 9.4 on the Spanish version, which was very high compared with the monolingual English scores, and which was close to his English score of 10. Subject 2's scores were within one standard deviation of each other, based on the monolingual group scores. During this task, the children were informed that the list contained only Spanish words, not English ones. However, the list contained two homographs with English words: hay, meaning "there is/there are", and come, meaning "s/he eats." Subject 1 read the words in English, but was reminded that the list contained only Spanish words, and then he tried to sound out the words in Spanish. Subject 3 refused to attempt to read any words in Spanish for this exercise. She continually told the examiner that she didn't learn to read in Spanish, and that she couldn't read Spanish, resulting in a score of 0.

Invented Spelling results indicated that spelling skills in English were stronger than in Spanish for all three subjects. Subject 1 attained a perfect score. Subject 2 attained a score that was average compared with the monolingual group norms, and subject 3 scored within one standard deviation of the mean of the English group for both tests. Only subject 3's English and Spanish scores for this subtest had a difference of greater than one standard deviation, based on monolingual group norms.

Discussion

Performance on the English version of the test by monolingual children seems to imply a hierarchical relationship among skills with alphabet recognition learned first, followed by concept of words, invented spelling, and word recognition. However, for the bilingual children, this ordering did not hold. In the English version of the test, the bilingual children scored highest on *Alphabet Recognition* and *Concept of Word*, and somewhat lower for *Word Recognition* and *Invented Spelling*. In the Spanish version of the test, the subtest with the highest scores was *Concept of Word*. *Alphabet Recognition* and *Invented Spelling* were close behind, and *Word Recognition* had the lowest scores.

These results may imply that once the concept of word is learned in a language, it is a concept that transfers to both languages. However, alphabet recognition and specific sound-letter correspondences must be taught explicitly for each language because letter names and corresponding phonemes are unique to each language.

The basic concept of matching phonemes with graphemes held across languages, evidenced by the children's attempts to sound out Spanish words in *Word Recognition* and *Invented Spelling* tasks. Although subject 3 refused to read any of the Spanish words, her total ERSI score on the Spanish version of the test still placed her in the normal range of the English monolingual scores, and her Spanish *Invented Spelling* score was within the normal range reported for monolingual children. For the bilingual children, *Invented Spelling* was a stronger skill than *Word Recognition*, and this may be because children used knowledge of the alphabetic principle to sound out Spanish words. Since Spanish words are more faithful to the phonemic principle (one symbol per sound), using a phonetic approach to spelling would be successful. *Word Recognition*, however, requires some knowledge of the few irregular sound-symbol correspondences in a language, which must likely be explicitly taught.

The bilingual children appeared to master two separate skill areas. The first area was made up of *Alphabet Knowledge* and *Concept of Word*. *Alphabet Knowledge* requires identification and naming of letter names, but it does not require application of the knowledge to a task, such as reading or spelling. Similarly, *Concept of Word*, asks children to recognize word boundaries rather than to read any words. In the two remaining subtests, children are asked to apply their knowledge of alphabet symbols and their corresponding sounds to spell and read words. Thus, *Alphabet Recognition* and *Concept of Word* are like the tools that children need before they move on to application of the phonemic principle in reading and spelling.

As mentioned previously, all three children had speech char-

acteristics that marked them as nonnative speakers of English, e.g. final consonant devoicing, and final consonant deletion; however, phonemic awareness as measured by the invented spelling task did not appear to be hampered by their proficiency in achieving native-like pronunciation. This supports Bruck and Genesee's claim (1995) that in spite of lower language skills in one of a bilingual child's two languages, phonological awareness skills may be equal in the two languages. From this, we can conclude that pronunciation skills of bilingual children are not necessarily directly linked to their phonological awareness skills. This would be important information for schools or teachers that continue to use oral language screenings as placement in reading groups.

Qualitatively, the children employed spelling strategies in English similar to those reported by Lombardino, Bedford, Fortier, Carter and Brandi (1997) in their description of typical spelling patterns of 100 kindergarten children on the invented spelling subtest of the ERSI. Omission and substitution patterns were present in all three subjects for English words. Additionally, some idiosyncratic patterns were noted. Subject 2 used an idiosyncratic pattern of "t" substitution as a type of place marker for medial sounds. He was able to accurately represent initial and final sounds, but medial sounds were often represented by "t." The pattern applied in Spanish and in English. Subject 3 used insertion of letters and erroneous letter patterns that reflected a lack of consistency beyond word-initial phonemes. This corresponds with her Spanish spelling, in which she wrote only the word-initial sound. Her lack of awareness of Spanish alphabet phoneme-grapheme correspondences may have led her to abandon her strategy of using additional letters in random patterns to represent additional sounds. Since no group studies on invented spelling of Spanish words have been conducted, no comparisons can be made for the Spanish spelling task.

Lombardino et al. (1997) described three groups of spelling learners, low, middle, and high, based on mean spelling score and type and frequency of response. In that study, the middle group mean spelling score was 5.98 (SD .657) and the high group mean spelling score was 8.23 (SD .632). Of the three bilingual subjects, two children (subjects 2 and 3) performed similarly to the middle group, and one child (subject 1) performed similarly to the high group based on mean spelling score. Atypical errors for each bilingual child are outlined in Table 3.

Atypical responses by bilingual children were similar to those produced by monolingual children. Subject 1, who had the highest spelling preliminary score, also had the fewest atypical errors. Likewise, subject 2 had fewer atypical patterns than subject 3, and he had a higher spelling score. The percentage of occurrence of each of these atypical responses by the high spelling group in the Lombardino et al study (1997) ranged from 9-56%. The bilingual children performed in a way both in terms of spelling score and error patterns that is consistent with the middle and high spelling groups. That is, atypical responses for the bilingual children were similar in type and occurrence to atypical responses for the monolingual group. It should also be noted that the atypical responses occurred on spelling correspondences that reflect the morphemic level of spelling identified by Masterson and Crede (1999), which is a higher level than the phonetic level. Thus, the bilingual children's atypical responses do not differentiate them in type from the monolingual group, nor do the responses indicate any influence from Spanish.

Because it has been reported that bilingual children are more likely than monolingual children to lack basic reading skills (Snow et al., 1988), it is important to carefully examine their performance on reading readiness tasks in an attempt to determine where deficits occur. Future research may examine the relationships between subtests of the ERSI in both English and in Spanish to see if at any point low scores on *Alphabet Recognition* and *Concept of Word* have a negative impact on the other two

Table 3. Atypical spelling responses for English spelling task by bilingual subjects

Stimuli/target spelling	Subject 1	Subject 2	Subject 3
Peeked / ed		Ptk	sa
feet / ee		Omission	re
dress/ ss	ese		r
lamp/ mp	ape	Utp	m
road / oa		T	a
step / e		T	d
junk / u		T	er
mail / ai	ee	T	g
chin / i		T	ra
dress / dr		dt	gdr
picking / ing		n	ro

subtests. Relationships between ERSI subtests and expressive language skills would also be an appropriate area of research. An in-depth study of bilingual spelling errors is warranted to examine specific influences from phonological differences between Spanish and English. Higher-level phonemic skills, such as manipulation of onset or coda clusters should be examined to assess overall phonemic awareness levels.

Clinical Implications

From the limited data collected in this pilot study, it appears that use of the English version of the ERSI may be sufficient to measure reading readiness in many bilingual children. Overall reading readiness levels of the bilingual children who participated in this study appear to be roughly the same as those of monolingual children who performed in the average to above-average range of the ERSI. Administration of the Spanish version of the test did not reveal any unexpected results that would differentiate bilingual children from monolingual children. For bilingual children who are able to participate normally in an English-speaking classroom, the ERSI may be an appropriate tool to use in testing reading readiness, and testing bilingual children in English may be sufficient to identify difficulty in the various skill areas.

Based on this small group of bilingual children, phoneme awareness and ability to match phoneme with grapheme seem to develop similarly to the way the skills develop in monolingual children. However, in order to more accurately assess phonemic awareness, more discrete tasks should be included, such as manipulation of individual cluster members.

Some general constructs appear to exist independent from language. For example, if a child has the concept of a word in English, s/he would also have the concept for Spanish words. Many alphabet letters correspond in name and sound in both languages, so a child's inability to recognize or produce alphabet sounds might imply a deeper difficulty with grapheme-phoneme correspondence rather than lack of knowledge of specific phonemes. Lack of use of patterns in English invented spelling would indicate that the child has not mastered either phoneme-grapheme correspondence or phoneme segmentation abilities, and these difficulties would likely exist in both languages as well. Although further testing in Spanish could be conducted for children who showed difficulties with the English version, it would not always be necessary, and in some cases where no explicit phoneme-grapheme instruction is provided in Spanish, it may yield results that indicate lower levels of readiness than the English test.

As seen in this study, children who have not fully mastered production of the sound system of English are probably able to master reading readiness skills to learn to read in English. In fact, reading instruction may reinforce their acquisition of the new sound system since it involves directing attention to each phoneme (Treiman & Zukowski, 1996).

For children who received early reading instruction in other countries and in other languages, the English version of the ERSI may not capture the child's true abilities, and a modified version of the test should be administered in those cases. In order to produce a linguistically appropriate version of the ERSI in another language, several factors must be considered. The phonemic and orthographic systems of the target language must be adequately represented. Selection of items for inclusion in the word recognition and invented spelling subtests must be made based on age-appropriateness and frequency of occurrence of the lexical items, transparency of orthography for each item, and word structure. Since many languages prefer open (CV) syllables to closed (CVC) syllables, matching items with the English test may be difficult. In this case, words that appear in the speech of young children should be used in spite of word shape. Methods of instruction and age at onset of formal instruction in the native language (and country) should be considered. Children who do not receive phoneme segmentation instruction, but are instructed using a whole language approach would not be expected to perform as well on word recognition tasks involving decodable words. Likewise, children who rely on phoneme segmentation skills in early reading instruction would not perform as well on word recognition for basal words.

To properly pilot this Spanish version of the ERSI, children who receive early literacy training in Spanish should be tested using the Spanish version to determine if it is an appropriate tool for assessment of reading readiness. Additional research using both the ERSI English Version and the ERSI Spanish Translation should be conducted with larger groups of young Spanish-English speaking children to further establish the validity and reliability of these two instruments when they are used with this population.

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Appendix A

Date: _____
Examiner: _____
Child: _____
Grade/Age: _____
School/Teacher: _____

ERSI SCORE FORM - SPANISH

ALPHABET KNOWLEDGE
Recognition Upper Case

A F L P W Z B H O J U C Y L Q M
D N S X I E G R V T LL CH N
 # CORRECT_____/29

Recognition Lower Case

a f k p w z b h o j u c y l q m
d n s x i e r v t g ll ch n
 # CORRECT_____/29

Production

A F L P W Z B H O J U C Y L Q M
D N S X I E G R V T LL CH N
 # CORRECT_____/29

CONCEPT OF WORD

	Pointing	Word
1. Katie esta caminando (1) bajo la lluvia (2).	_____	1____2____
2. Ella (1) ve a un perro grande (2).	_____	1____2____
3. El perro (1) sacude el agua (2) a Katie.	_____	1____2____

 # CORRECT (pointing)_____/3 (words)_____/6 = _____/9

MY HOME STORY BOOK

1. Mi casa esta aqui, dijo el pajarito.	_____	_____
2. Mi casa esta aqui, dijo el sapo.	_____	_____
3. Mi casa esta aqui, dijo el cerdo.		_____
4. Mi casa esta aqui, dijo el perro.		_____
5. Mi casa esta aqui, dijo el conejo, y adentro me voy.		_____

 # CORRECT (pointing) _____/5 (words)_____/2 = _____/7

Appendix A (continued)

INVENTED SPELLING

1. pato _____
2. sin _____
3. feo _____
4. rana _____
5. ano _____
6. taza _____
7. vaca _____
8. dice _____
9. pollo _____
10. corre _____
11. mucho _____
12. ven _____

Trials: por_____
mes_____

TOTAL POINTS _____/45

WORD RECOGNITION

BASAL

1. hay _____
2. va _____
3. soy _____
4. que _____
5. hasta _____
6. esta _____
7. vez _____
8. llama _____
9. muy _____
10. quien _____

CORRECT_____/10

DECODABLE

1. oso _____
2. come _____
3. pan _____
4. malo _____
5. sol _____
6. toma _____
7. nido _____
8. bano _____
9. bien _____
10. dedo _____

CORRECT_____/10

SUMMARY OF SCORES

ALPHABET
RecUpper /29 RecLower /29 Prod. /29 /87 X 10=_____

CONCEPT OF WORDS
Point /8 Word /8 /16 X 10=_____

INVENTED SPELLING
Phoneme Points /45 /45 X 10=_____

WORD RECOGNITION
Basal /10 Decodable /10 /20 X 10=_____

TOTAL ERSI SCORE /40=_____

60

Appendix B

Date: _____
Examiner: _____
Child: _____
Grade/Age: _____
School/Teacher: _____

ERSI SCORE FORM - ENGLISH

ALPHABET KNOWLEDGE

Recognition Upper Case

A F K P W Z B H O J U C Y L Q M
D N S X I E G R V T
 # CORRECT_____/26

Recognition Lower Case

a f k p w z b h o j u c y l q m
d n s x i e r v t g
 # CORRECT_____/26

Production

A F K P W Z B H O J U C Y L Q M
D N S X I E G R V T
 # CORRECT_____/26

CONCEPT OF WORD

	Pointing (1)	Word (2)
1. Katie is walking in the rain.	_____	1___2____
2. She sees a big dog.	_____	1___2____
3 The dog shakes water on Katie.	_____	1___2____

 # CORRECT (pointing)____/3 (words)____/6 = _____/9

MY HOME STORY BOOK

1. My home is here, said the bird.	_____	_____
2. My home is here, said the frog.	_____	_____
3. My home is here, said the pig.	_____	
4. My home is here, said the dog.	_____	
5. My home is here said the rabbit and in I go.	_____	

 # CORRECT (pointing)_____/5 (words)____/2 = _____/7

Appendix B (continued)

INVENTED SPELLING

Trials: mat_____ lip_____

1. back _____
2. feet _____
3. step _____
4. junk _____
5. picking _____
6. mail _____
7. side _____
8. chin _____
9. dress _____
10. peeked _____
11. lamp _____
12. road _____

 # POINTS _____/42

WORD RECOGNITION

BASAL

1. is _____
2. and _____
3. look _____
4. has _____
5. see _____
6. help _____
7. come _____
8. what _____
9. go _____
10. like _____

 # CORRECT_____/10

DECODABLE

1. cap _____
2. net _____
3. win _____
4. bug _____
5. fat _____
6. mop _____
7. led _____
8. dig _____
9. job _____
10. road _____

 # CORRECT_____/10

SUMMARY OF SCORES

ALPHABET

RecUpper /26 RecLower /26 Prod. /26 **/78 X 10 = _____**

CONCEPT OF WORDS

Point /8 Word /8 **/16 X 10 = _____**

INVENTED SPELLING

Phoneme Points /42 **/42 X 10 = _____**

WORD RECOGNITION

Basal /10 Decodable /10 **/20 X 10 = _____**

TOTAL ERSI SCORE **/40 = _____**

62

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May 2002

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Continuing Education Questions

"Using Descriptive Language Assessment Procedures with African American English Preschool Child Speakers: Advantages and Limitations"

1. Damico's (1993) classification system for categorizing descriptive language assessment procedures include:

   A. probe procedures
   B. behavioral sampling procedures
   C. rating scale, checklist, and questionnaire procedures
   D. All of the above
   E. A and B

2. Which of the following was not described as a "behavioral sampling procedure?"

   A. play-based assessment activities
   B. elicitation tasks
   C. language sampling
   D. story grammar tasks
   E. A and C

3. A procedures that can be used to analyze young children's spontaneous, self-generated semantic skills include:

   A. Mean Length of Response.
   B. Fey's Conversational Classification Scheme
   C. Type-Token Ratio
   D. Developmental Sentence Score System
   E. All of the above

4. Researchers and clinicians have argued that:

   A. most formal, norm-referenced language assessment procedures are valid for evaluating the linguistic abilities of African American English child speakers
   B. most formal, norm-referenced language assessment procedures reflect the values and mores of non-African American English speakers
   C. most formal, norm-referenced language assessment procedures provide reliable results when evaluating the linguistic abilities of African American English child speakers
   D. All of the above
   E. None of the above

5. The frequency in which African American English features are produced by children can be influenced by the following factors:

   A. socioeconomic status
   B. linguistic task
   C. ethnic background of conversational partner
   D. conversational topic(s)
   E. All of the above

6. "Best practice" for using descriptive language assessment procedures to evaluate the linguistic skills of African American English (AAE) child speakers would suggest that:

   A. a variety of descriptive language assessment procedures should be used during speech and language evaluations of AAE child speakers' linguistic skills
   B. clinicians should be mindful that AAE child speakers' verbal and nonverbal behaviors frequently reflect their cultural backgrounds.
   C. clinicians should freely use norms that do not reflect the linguistic abilities of AAE child speakers
   D. A and C
   E. A and B

64

Continuing Education Questions (cont.)

"Format Frequency Differences in Vowels Produced by African American and Caucasian Male Speakers"

1. Formant frequencies relate to the important acoustic differences between the various vowels. Formant frequencies are:

   A. the same as the fundamental frequency
   B. multiples of the fundamental frequency
   C. measured in Hertz
   D. similar for each vowel

2. The fundamental frequency of phonation:

   A. is a product of vocal cavity resonance
   B. is similar for men and women
   C. is the first harmonic
   D. can be predicted from formant frequencies

3. What was different about the vowels used in this study, compared to the two previous studies of formant frequency productions in African-American speakers cited?

   A. Vowels came from real words
   B. Vowels were sustained isolated productions
   C. Vowels were sung at a constant fundamental frequency
   D. Vowels were excised from conversational speech

4. The main findings of this article can generally be summarized by which of the following acoustic differences for African-American male speakers?

   A. Lower fundamental frequencies
   B. Higher formant frequencies
   C. Lower formant frequencies
   D. Shorter Voice Onset Time (VOT)

5. Which of the following acoustic characteristics were suggested to account for more missing formant frequencies in the African-American male speakers?

   A. More nasalization
   B. More spirantization
   C. More affrication
   D. More diphthongization

6. Although not controlled in this study, which of the following physical differences might also account for formant frequency differences.

   A. Physical size
   B. Slower speech rate
   C. Larger lung capacity
   D. Greater singing ability

"The Consistency of Kay Elemetrics Multidimensional Voice Program (MDVP) for the Acoustic Analysis of the Dysphonic Voice"

1. The benefit of using automated systems for the acoustic analysis of speech and voice are:

   A. to replace perceptual evaluation
   B. to complement perceptual and physiological evaluation
   C. to demonstrate the clinical abilities of speech-language pathologists
   D. for billing purposes

2. "Automated systems for the acoustic analysis of speech and voice (such as MDVP) are consistent."

   A. I agree with the statement with no reservation
   B. I do not agree with this statement
   C. There is no evidence in the literature to support such a statement
   D. I need more information about the nature of the voice tested to accept or reject this statement

3. MDVP was proved to be consistent for measuring the acoustic properties of the normal voice. It would be safe, then, to assume that:

   A. it is also consistent for measuring the acoustic properties for the mildly dysphonic voice
   B. it is also consistent for measuring the acoustic properties for the severely dysphonic voice
   C. the inherent properties of the acoustic signal and voice quality should be first investigated

4. Some factors that would potentially render MDVP inconsistent for the analysis of the acoustic properties of the human voice are:

   A. inconstant mouth-to-microphone distance
   B. variable sampling rate
   C. signal peak-clipping
   D. variable loudness
   E. All of the above

Continuing Education Questions (cont.)

"The Consistency of Kay Elemetrics Multidimensional Voice Program (MDVP) for the Acoustic Analysis of the Dysphonic Voice" (continued)

5. Consulting technical manuals and understanding the technical properties of automated systems for the acoustic analysis of speech and voice is:

   A. the responsibility of every speech-language pathologist
   B. a matter of personal preference and level of familiarity
   C. the responsibility of technical support personnel
   D. the responsibility of just those speech-language pathologists who specialize in voice evaluation and treatment

6. If you were to conduct research testing the consistency of MDVP for the acoustic analysis of organic voice disorders, you would predict the result to be:

   A. MDVP is inconsistent because of the high vocal perturbation in such disorders
   B. MDVP is consistent because it was proved to be consistent for the mildly and severely dysphonic voice
   C. the two possibilities are worth consideration
   D. clinicians should not make such predictions since they are not researchers

"Successful Educational Re-Entry After Severe Traumatic Brain Injury: The Contribution of Cognitive Compensation Strategies"

1. The academic recoveries attained by the students were attributed to compensation strategies focusing on the areas of:

   A. teading recognition and comprehension
   B. verbal memory and executive skills
   C. inductive and deductive reasoning
   D. All of the above

2. Pioneering contributions to the field of cognitive rehabilitation were made by:

   A. Richard Alpert
   B. Walter Fischer
   C. James Witaschek
   D. Yigal Gross

3. A naturally-occurring cognitive procedure which adjusts behavioral output to meet the level of task difficulty is called a response _____ subroutine.

   A. modification
   B. utilization
   C. optimization
   D. implementation

4. Which of the following was a key characteristic shown in the present study to be associated with successful return to school?

   A. Verbal I.Q. and neuropsychological test scores
   B. Duration of coma and post-traumatic amnesia
   C. Location of brain lesion
   D. Participation in the rehabilitation program

5. Which conclusion is most appropriate on the basis of the results of the study?

   A. Brain injured students should not be placed in mainstream education for at least two years
   B. Students with severe injuries require special education, while those with mild injuries usually can be placed in mainstream programs
   C. Most brain injured students can be placed directly in mainstream classrooms if adequately rehabilitated
   D. None of the above

6. What limitation did students in the successful recovery group encounter?

   A. Limited academic course load
   B. Social and behavioral deficits
   C. Need for tutorial help
   D. Problems in self-esteem

7. In terms of public policy, the results of this study indicate that brain injured students need:

   A. greater access to special education programs designed specifically for traumatic brain injury
   B. greater access to rehabilitation training prior to school re-entry
   C. psychological support and long-term follow-up care
   D. All of the above

8. Which of the following describes a severe traumatic brain injury as defined in the research literature?

   A. Depressed skull fracture with craniotomy
   B. Comatose upon arrival at the hospital
   C. Post-traumatic amnesia greater than six hours
   D. Intelligence testing two or more standard deviations below grade placement

Continuing Education Questions (cont.)

"Phonological Development in African-American Children Prenatally Exposed to Cocaine"

1. According to recent statistics, approximately how many infants are born prenatally exposed to cocaine?

   A. 4%
   B. 5%-10%
   C. 40%
   D. 50%

2. Even though the rates of substance abuse in African American and white women are reportedly similar, the proportion of black women who are reported to public health authorities is estimated to be approximately:

   A. ten times higher
   B. four times higher
   C. twice as lower
   D. higher especially for African American women who are of childbearing age

3. Children born prenatally exposed to cocaine are at- risk for the following difficulties:

   A. otitis media
   B. attention deficit disorder
   C. cognitive, language and phonological disorders
   D. All of the above

4. Findings of research studies investigating prenatal cocaine exposure must be interpreted with caution for which of the following reasons:

   A. several studies have included children prenatally exposed to cocaine as well as other drugs such as meta-amphetamines, alcohol and marijuana
   B. that children prenatally exposed to drugs are at greater risk for Fetal Alcohol Syndrome
   C. there are a host of methodological issues such as small sample sizes, use of culturally biased assessment tools, and lack of control of confounding variables such as pre-term birth, low birth weight and prenatal exposure to other toxic substances, which may influence the outcome of studies
   D. children prenatally exposed to cocaine typically have middle ear infections

5. Research on prenatally drug-exposed toddlers suggests that compared to typically developing toddlers, PDE toddlers are likely to exhibit:

   A. restricted phonemic inventories and decreased intelligibility
   B. restricted phonemic inventories, decreased intelligibility and oral motor difficulties
   C. restricted phonemic inventories, decreased intelligibility more simplistic word or differing word shapes and more frequently occurring immature phonological processes
   D. All of the above

6. Given that the focus on the current study was to contrast the early phonological development of African -American toddlers prenatally exposed to cocaine to that of non-exposed toddlers from the same speech community, it seems reasonable to examine which aspects of language development?

   A. pragmatics and discourse skills, phonemic inventories and oral motor skills
   B. phoneme acquisition, frequency of phonological processes and word shapes
   C. phoneme acquisition, frequency of phonological processes and shapes and possible emergent dialect patterns
   D. phoneme acquisition, frequency of phonological processes and discourse skills

7. Methods to collect phonological data on the subjects included which of the following?

   A. collecting a language sample and administering the Goldman Fristoe Test of Articulation
   B. audio and video recorded language samples and the Weiss Comprehensive Test of Articulation
   C. extraction of phonological data from audio and video recorded language samples for computer analysis
   D. extraction of phonological data from audio and video recorded language samples for analysis via the Interactive System for Phonological Analysis to determine phonemic inventory, phonological process use and word shapes. Subsequent analysis included investigating possible phonological patterns typical of AAE

8. The results of this study indicated:

   A. that the phonetic inventories produced by all subjects in both groups revealed marginal use of most of the phonemes, similar phonological process use, similar word shape use and emergent dialect patterns
   B. that prenatally drug exposed subjects had only vowels and bilabials and significantly more immature and aberrant phonological process patterns
   C. that both groups were phonologically impaired as determined by phonetic inventories, phonological processes and oral motor abilities
   D. None of the above

9. The findings of the study also indicate that dialect influences:

   A. rendered the subjects significantly unintelligible
   B. while emergent were difficult to discern given the young age of the subjects
   C. are also more likely to become evident with age and as a result, school based clinicians should continue to monitor the phonological development of PDE AA toddlers until their school age years, while patterns could be made
   D. B and C

Continuing Education Questions (cont.)

"Phonological Development in African-American Children Prenatally Exposed to Cocaine"

10. Despite findings of no statistically significant differences between groups prenatally drug exposed (PDE) AA toddlers may still be at risk for:

    A. later phonological awareness, reading, and academic difficulties
    B. HIV and neglect
    C. A & B
    D. All of the above

The Early Reading Screening Instrument: A Spanish Translation and Preliminary Study of Three Bilingual Children

1. Which of the following pre-reading skills is not measured by the ERSI?

    A. Rapid Automatic Naming
    B. Invented Spelling
    C. Alphabet Recognition

2. The ability to reflect on speech and segment it into its phonological constituents is referred to as:

    A. phonemic awareness
    B. metalinguistic awareness
    C. phonological awareness

3. The stage of phonological awareness associated with sound-letter patterns is:

    A. word-level
    B. onset-rime level
    C. phonemic level
    D. syllable level

4. Which level of phonological awareness is the highest?

    A. Word level
    B. Onset-rime level
    C. Phonemic level
    D. Syllable level

5. A transparent orthography may also called:

    A. deep
    B. simple
    C. shallow

6. An orthography that is transparent has a _____ number of one-to-one sound letter correspondences than an orthography that is deep.

    A. greater
    B. equal
    C. fewer

7. Invented spelling refers to a child's ability to:

    A. correctly spell basal words
    B. use letters to represent sounds in words
    C. decode words

8. In a study by Lombardino et al (1999) performance on the ERSI was found to correlate with:

    A. phonological awareness level
    B. invented spelling ability
    C. reading achievement
    D. reading disability

Answer Sheet

Florida Journal of Communication Disorders • Volume 20 • 2000

Circle the correct answer to each question.

Course Instructions: Circle the correct answer to each question on the answer sheet below. Complete the course evaluation on page 70. Complete the contact information on page 63. Detach pages 63, 69 and 70 from the Journal and return to FLASHA with your payment. Please allow 10 to 12 working days from the date your answers are received for your test to be processed.

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Article One (page 7)

1.	A	B	C	D	E
2.	A	B	C	D	E
3.	A	B	C	D	E
4.	A	B	C	D	E
5.	A	B	C	D	E
6.	A	B	C	D	E

Article Two (page 19)

1.	A	B	C	D
2.	A	B	C	D
3.	A	B	C	D
4.	A	B	C	D
5.	A	B	C	D
6.	A	B	C	D

Article Three (page 23)

1.	A	B	C	D	
2.	A	B	C	D	
3.	A	B	C		
4.	A	B	C	D	E
5.	A	B	C	D	
6.	A	B	C	D	

Article Four (page 28)

1.	A	B	C	D
2.	A	B	C	D
3.	A	B	C	D
4.	A	B	C	D
5.	A	B	C	D
6.	A	B	C	D
7.	A	B	C	D
8.	A	B	C	D

Article Five (page 37)

1.	A	B	C	D
2.	A	B	C	D
3.	A	B	C	D
4.	A	B	C	D
5.	A	B	C	D
6.	A	B	C	D
7.	A	B	C	D
8.	A	B	C	D
9.	A	B	C	D
10.	A	B	C	D

Article Six (page 51)

1.	A	B	C	
2.	A	B	C	
3.	A	B	C	D
4.	A	B	C	D
5.	A	B	C	
6.	A	B	C	
7.	A	B	C	
8.	A	B	C	D

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Read each statement carefully, then select one of the following alternatives: Strongly Agree (1); Agree (2); Neutral (3); Disagree (4); Strongly Disagree (5).

1.	This activity had clearly stated objectives.	1	2	3	4	5
2.	My instructor(s) communicated a clear understanding of course content.	1	2	3	4	5
3.	This activity built understanding of concepts and principles.	1	2	3	4	5
4.	The content of this activity was described adequately during advance publicity.	1	2	3	4	5
5.	My instructor(s) helped me apply theory to solve problems.	1	2	3	4	5
6.	The level of difficulty of this activity was consistent with my prior expectations.	1	2	3	4	5
7.	The activity organization allowed for maximum learning.	1	2	3	4	5
8.	Audiovisuals and supplementary study materials were an asset to this activity.	1	2	3	4	5
9.	I will incorporate the knowledge and/or skills gained from this activity into my work.	1	2	3	4	5
10.	This activity will contribute to my professional growth.	1	2	3	4	5
11.	This activity will motivate me to seek further continuing education.	1	2	3	4	5
12.	Overall, this activity was outstanding.	1	2	3	4	5

The following are optional:

Birth date:_____ Sex: ❒ Male ❒ Female

Racial/Ethnic Background:

❒ Hispanic

❒ American Indian or Alaskan Native

❒ Asian or Pacific Islander

❒ Black (not Hispanic)

❒ White (not Hispanic)

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